Journal of the Society of Arts.

FRIDAY, MAY 29, 1863.

WOOD CARVING.

EXHIBITION AND OFFER OF PREMIUMS.

The Council have had under consideration a communication from the Society of Wood Carvers, asking the aid of the Society of Arts in promoting the art of wood carving in this country, and they have agreed to allow the use of the Society's rooms for the purpose of holding an Exhibition of Wood Carving, both modern and ancient, in the month of June, 1863. The Council have further agreed to offer the Society's Silver Medal and to make a grant of £30, the Society of Wood Carvers giving £15, as a fund for prizes to be awarded to exhibitors on that occasion, in the following divisions, provided that in the opinion of the judges the articles possess sufficient merit, thus:—

FIRST DIVISION.

Human figure in alto or bas relief. Animals or natural foliage may be used as accessories.

1st Prize of £8 and the Society's Silver Medal.
2nd Prize of £4.
3rd Prize of £3.

SECOND DIVISION.

Animal or Still Life. Fruit, flowers, or natural foliage, may be used as accessories.

1st Prize of £8.
2nd Prize of £4.
3rd Prize of £3.

THIRD DIVISION.

Natural foliage, fruit, or flowers, or conventional ornament in which grotesque figures or animals may form accessories, preference being given where the work is of an applied character for ordinary decorative purposes, as representing commercial value.

1st Prize of £8.
2nd Prize of £4.
3rd Prize of £3.

Employers or private owners may be Exhibitors, but *bona fide* workmen only can receive prizes.

The prizes are open to all Art workmen in Great Britain, whether belonging to the Society of Wood Carvers or not.

The judges will be selected as follows:—Four by the Council of the Society of Arts, and three by the Society of Wood Carvers.

All articles for exhibition and competition must be sent in to the Society's House on or before Monday next, the 1st of June, 1863, and must be delivered free of all charges. Each work sent in competition for a prize must be marked with the workman's name, or, if preferred, with a cypher, accompanied by a sealed envelope giving the name and address of the workman. With the articles, a description for insertion in the Catalogue should be sent.

Before the award of the prizes is confirmed, the Candidate must be prepared to execute some piece of work sufficient to satisfy the Council of his competency.

Although great care will be taken of articles sent for Exhibition, the Council will not be responsible for any accident or damages of any kind occurring at any time.

Prices may be attached to articles exhibited and sales made, and no charge will be made in respect of any such sales.

TWELFTH ANNUAL CONFERENCE.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

The Twelfth Annual Conference of the Representatives of the Institutions in Union and the Local Educational Boards with the Council will be held on Friday, the 12th June, at Twelve o'clock, noon. Sir THOMAS PHILLIPS, F.G.S., Chairman of the Council, will preside.

Secretaries of Institutions in Union are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the names of the Representatives appointed to attend the Conference. The Chairmen or other Representatives of the Local Boards of Examiners are invited to attend the Conference.

The Council will lay before the Conference the Secretary's Report of the Proceedings of the Union for the past year, and the Results of the Examinations of the Central Committee of Educational Unions. The time for holding the Society's Examinations next year will also be considered.

The following subjects are suggested for discussion:—

1. Whether in the Elementary Examinations, in addition to the uniformity already, to a great extent, secured by the supply of the same papers of questions to the various Local Boards, further uniformity may not be obtained by a plan for aiding the Local Examiners in the estimation of the Candidates' answers?

2. Whether it is desirable to dispense with the "Previous Examinations" in *special* subjects?

3. The propriety of the Society of Arts employing an Organising Agent to visit the various Institutions.

4. How far is it desirable and practicable to combine the objects of the Working Men's Clubs—viz., amusements, draughts, chess, refreshment, &c., with the educational objects of Mechanics' Institutes, and whether the members of Institutes can be retained during the summer, by providing healthful recreation and studies requiring illustration from nature?

5. The propriety of holding one or more meetings of Representatives of Institutes about the time of the Annual Conference at the Society of Arts, for the purpose of reading short papers or essays on various subjects of interest.

6. The expediency and means of establishing competitive exhibitions of the Works of Art Workmen and Skilled Artisans.

7. Whether it would be expedient that Apprentices should be examined, at the conclusion of their term, in the principles and practice of their craft or business, and Certificates granted to them?

8. Whether it would not be desirable for Institutions to give Testimonials to their members, and to keep registers of those so recommended by other Institutions?

9. The expediency of holding local competitions in Shorthand.

Notice of any other subjects which Representatives may desire to introduce to the notice of the Conference should be given to the Secretary of the Society of Arts, to whom should also be forwarded a copy of the last Annual Report of each Institution.

Representatives of Institutions and Local Boards attending the Conference are invited to the Society's Conversazione, at the South Kensington Museum, in the evening of the same day (12th June), and will receive cards on application at the Society's House on the day of the Conference.

CONVERSAZIONE.

The Council have arranged for a Conversazione at the South Kensington Museum, on Friday evening, the 12th June, for which cards have been issued.

THE SOCIETY'S MEMORIAL OF THE PRINCE CONSORT.

The following additional names have been received up to the 28th inst.:—

Aldam, William	£1	1	0
Hopkins, Evan	1	1	0
Perkins, Ainger March	1	1	0
Robinson, George	0	10	0
Rolls, R. H.	1	1	0
Villiers, Rt. Hon. C. Pelham, M.P.	1	1	0
Wilson, Lestock Peach	1	1	0

DWELLINGS FOR THE WORKING CLASSES.

With a view to promote enlarged investments of capital in model dwellings and other establishments for the benefit of the working classes, the Council of the Society of Arts has instituted a statistical inquiry into the results hitherto obtained, including family dwellings of every description, model lodging-houses, dormitories, refuges, baths and washhouses, soup kitchens, coffee-houses, &c.

Members and others who can supply information or indicate sources where it may be obtained, are requested to communicate with the Secretary, who will send blank forms for being filled up with the required data.

COMMITTEES OF REFERENCE.

THE COLONIES.

A Meeting of the Committee on the Colonies took place on Friday afternoon, 22nd of May, Sir Thomas Phillips, Chairman of the Council, in the chair.

The CHAIRMAN, in opening the meeting, remarked that the colonies were a subject of the greatest interest. The relation of the home government to the colonies, and the relation of the colonies *inter se*—the modes by which the productions of the colonies might be made known in this country, and by which that interchange might take place which was calculated to promote the interests of all parties—were topics which had often been considered in that room, and which might always be considered usefully.

Mr. FITZGERALD said, being a landholder in West Australia, and being anxious for the welfare of that colony, he might mention that he had been informed that there was a tree there which yields a gum called the "Black-boy gum," and this, when dissolved in spirits of wine, was used for colouring. He could procure a sample of this gum for the Society to examine if they thought it worth attention. Then there was the "red gum," a powerful astringent, and very useful in cases of diarrhœa. It was exhibited at the International Exhibition, but was but little known in this country. There were immense tracts of sandy land in West Australia, where one variety of the wild castor-oil plant grew, and he believed it was that on which the *Bombyx Cynthia* fed, which produced that rough kind of silk which came from the Burmese territory. That, also, he thought, might be brought before the consideration of the colonies by offering a premium for its production. He would mention that lately he sent a cwt. of Sea Island cotton to this colony to see how it would grow there. The seed was a portion of that captured at New Orleans by the Federal forces lately, and which he obtained from the Cotton Supply Association at Manchester. There was every reason to believe that the condition of that colony was such that cotton might be produced there at a lower rate than almost anywhere else. It was a question of labour, with which was mixed up the subject of coolie emigration.

Mr. P. L. SIMMONDS remarked that the black-boy gum or resin was a well known article of commerce, and was called by two or three different names. It yielded a yellow dye, and was used to a small extent by varnish makers, and also medicinally. In the colonies it had been tried for gas making and for other purposes, and he did not think anything could be done to stimulate its production more than had been done by the colonists themselves. The red gum had been spoken very favourably of in the colonies, and possessed valuable medicinal qualities. It was a good astringent. Another product was the West Australian mahogany, a series of *Eucalyptus*, which possessed remarkable properties for shipbuilding.

Mr. ASHWORTH remarked that it was rather more than a year ago that he had the honour to submit to this Society a paper entitled "Our Colonies, their Commerce, and their Cost," and seeing he was connected with commerce, he took it for granted that he had claims to be heard on the commercial aspect of this question. Our colonial affairs were largely mixed up with military, naval, ecclesiastical, judicial, and governmental matters, each of which was deemed exceedingly important. The commercial aspect ought not to be entirely overlooked, inasmuch as the expenditure for the colonies in this country amounted to a very large sum. It was not only necessary, but expedient, that we should now and then "take stock" (to use a commercial phrase) in regard to the expenses we incur in comparison with the advantages, or probable advantages, to be derived from the occupation of those colonies; in fact, the expenses attending our colonial management had already had the effect of raising in this country very important considerations as to the policy or impolicy of holding or abandoning our colonial possessions. He did not mean to say that the country had arrived at the conclusion that we should be better divested of our colo-

nies, but from what he had seen he believed their management required a much closer investigation than we had hitherto bestowed upon it. It was cheering to anticipate, at a time like the present, that from Queensland especially we were likely to derive a considerable quantity of very excellent cotton. It would have been gratifying if we could have seen that our West India colonies had promised favourably in the way of cotton culture. In those islands we had a very wide range of soil capable of producing cotton, if we knew how to use it. We had ceased to receive from that region any large amount of cotton for a long time back; and now, when we were casting about and considering in what manner the material could be supplied; when even the Sultan had become awakened to the advantages of cotton culture; when the people of Italy, Algeria, Paraguay, and other countries, had begun to take advantage of the inquiry for it, it was remarkable that, when public companies were formed here for its cultivation, they received very little support in our colonies. In Jamaica but little money had been subscribed for that purpose; but in Queensland more assistance had been given. Referring to the colonies, he found in a return moved for a few weeks since by Mr. Bazley, that the expenses incurred by the home government in the West India islands for governors amounted to £20,000, and that in the judicial department the cost was about £6,300 a year, whilst the ecclesiastical cost £20,700. All this was paid by the home government, and was irrespective of the amount paid for military purposes. In Canada we had a fearful picture of colonial misgovernment. Its population was about equal to that of Lancashire—something like 2,500,000—and the expenses we incurred to govern that people were enormous. A large portion of Lower Canada was peopled by a low description of French population, a class of people who divided and subdivided the land into very minute portions, and who had nothing to sell, and no money wherewith to buy. Mr. Ashworth then referred to the colonies as being unfettered in their commerce, and permitted to sell and buy wherever they pleased; and in reference to Canada he said that less than one-half of what they sold came to this country, and less than one-half of what they bought was sent from us. The Canadians were allowed to take charge of their own affairs, but they were very chary about serving as militia. They would not offend the Americans by placing themselves in a defensive attitude, and if anything was to be done for the protection of the country from foreign aggression it must be done at the expense of the mother country. He believed if we were to look back for the last fifty years, we should find our military expenses for Canada had been something like half-a-million a year. The Canadians argued that this expenditure was not incurred on their behalf, but that their country was made the receptacle for supernumerary soldiers, as they could be conveniently accommodated there, away from the sight of the British tax-payer. He thought these were characteristics of our colonial system which might properly be brought under the discussion of this Society; and if the Committee were disposed to take up questions of this nature, he should be ready to investigate the advantages and disadvantages which accrued to this country in regard to the commercial aspect of our colonial system.

Mr. FITZGERALD believed that the Manchester Chamber of Commerce last year were by no means unanimous in considering the colonies as incumbrances on the national treasury.

Sir THOMAS PHILLIPS being obliged to leave the meeting, the chair was, during the remainder of the discussion, occupied by Mr. WILLIAM HAWES.

The CHAIRMAN had heard only the latter part of Mr. Ashworth's observations, but he should decidedly object to the committee taking up the question politically. He knew Mr. Ashworth's views with regard to the colonies, and differed from them. The question of the cost of the colonies was matter of scarcely any moment at all compared to their enormous value to this country, and to the duty the country owed to those persons who had emigrated from our shores. He looked upon this expenditure as being for the protection of the Queen's subjects in her respective colonies. The object of this committee was to make suggestions which might help to develop the industries of the colonies, with a view to bringing before the people of this country the best fields open for them, and for the utilisation of a great variety of products, many of which were scarcely known.

Mr. ASHWORTH disclaimed that he took merely a political view of the colonies, remarking that his observations were on their commercial aspect.

Mr. FITZGERALD thought it would be very difficult to draw a line between politics and commerce, as regarded this question.

Mr. ASHWORTH conceived that after what we had done for Canada, that colony was not wise in raising its tariff against this country. A duty of 20 per cent. was a large tax to impose upon British manufactures, to a country which was year by year involving us in expensive government. Moreover, when we saw their tariff very often run parallel with that of the United States, we could not fail to imagine there was a species of harmony prevailing between the policies of the two countries. He thought this committee would do wisely to discriminate between those colonies which were acting in harmony with the mother-country and those which were not.

The CHAIRMAN agreed with Mr. Ashworth that it was a hard case that Canada should be allowed to put any amount of duty upon the manufactures of this country. But whether it arose through any sympathy between them and the United States, he was not prepared to say. It was a great disadvantage to our manufacturers, and he thought there ought to be a little more reciprocity in this matter.

Mr. BROOMHALL asked whether this high rate of duty was confined to Canada?

The CHAIRMAN replied that it was not. It was gradually creeping over all the colonies. Cape Colony, which had a duty of 5 per cent., had recently raised it to 7½ per cent., and he believed the same thing had been done in some of the Australian colonies.

Mr. BROOMHALL said that when he went to India, twenty-one years ago, the duty was 2½ per cent.; it was raised to 3½ per cent.; then to 5; and subsequently to 10 per cent.; so that the case of Canada was not an isolated one.

The CHAIRMAN said that in Canada the duty in some instances had gone up to 25 per cent. They must not, however, judge of the question purely by the rate of tariff. It was mixed up also with the question of taxation. It was clear if the colonists paid income taxes or assessed taxes, in lieu of taxes upon imports, it would affect the industry of the colonies nearly as much. The import duties were doubtless evaded to a certain extent along the extensive frontier of Canada.

Mr. BROOMHALL remarked, in regard to India, that, owing to the mode of levying taxes there, it was frequently the case that the Europeans paid scarcely any duty at all. When the matter was under discussion in the Houses of Parliament, Lord Stanley spoke to him on the subject, and he (Mr. Broomhill) told him that all the taxes he paid in India did not exceed fourteen shillings a year.

A discussion ensued as to the mode of procedure to be observed at the next meeting of the Committee.

TWENTY-FOURTH ORDINARY MEETING.

WEDNESDAY, MAY 27, 1863.

The Twenty-Fourth Ordinary Meeting of the One Hundred and Ninth Session was held on

Wednesday, the 27th inst., Thomas Winkworth, Esq., Member of Council, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Drake, Henry	24, Duke-street, Westminster, S.W.
Eales, Christopher	9, Welbeck-street, Cavendish-square, W.
Edney, William	38, Finchley-road, St. John's-wood, N.W.
Elliot, Russel	101, Long-acre, W.C.
Elt, Charles Henry	1, Noel-street, Islington, N.
Hammick, James Thos.	Census Office, Craig's-court, S.W., and 6, Winchester-road, Hampstead, N.W.
Roper-Curzon, Hon. H.	47, Argyll-road, Kensington, W.
Smith, W. H.	150, Leadenhall-street, E.C.
Taylor, John	Egremont-villa, Lower Norwood, S.

The Paper read was—

DESTRUCTIVE DISTILLATION, CONSIDERED IN REFERENCE TO MODERN INDUSTRIAL ARTS.

By B. H. PAUL, PH.D.

The effects produced by the application of heat to various substances must have been among the earliest observed chemical phenomena. The differences existing between the effects produced by heat upon different substances, were recognised at a very remote period in the history of chemistry, and among them the phenomena of distillation received especial attention. In some cases the application of heat to a substance has the effect of dissipating it entirely; such substances, of which water is a familiar example, are said to be volatile, and if substances of this kind are heated in closed vessels of suitable construction they may be recovered again, in their original condition, by the condensation of their vapour. This, in the strictest sense of the term, constitutes distillation. The volatile substance, absorbing the heat applied to it, becomes converted into vapour;—by abstracting from that vapour the heat which has been absorbed, it is converted into the original substance. In this way distillation is employed as a means of separating volatile substances from others which are not volatile, and which are, in contradistinction, termed fixed substances. This distinction between fixed and volatile substances is, however, in most cases merely relative, and it applies only to such a range of temperature as is commonly attainable. There are good reasons for the opinion that the substances commonly regarded as fixed, might be converted into vapour if their temperature could be increased to a sufficient degree. But among the substances which, in this limited sense, are termed fixed, there are some which certainly cannot be converted into vapour, in any case, without entirely losing their identity; without, in other words, being converted into totally different substances. Thus, for instance, wood is not a volatile substance, and at the same time it is not a fixed substance, except within a certain limited range of temperature. When heated much above the boiling point of water, wood is partially converted into vapour, to an extent proportionate to the temperature employed, but the vapour so produced cannot be reconverted into wood by cooling it, as the vapour of water can be reconverted into water. The change produced by the heating is a true chemical change. Most substances analogous to wood undergo a change of this nature when heated in close vessels; they are, in chemical language, decomposed, and the substances into which they are converted are called the products of the decomposition. These products are partly volatile. It is only in this way that substances which are not in themselves volatile can be said to distil, and it is this conversion of substances, by the application of heat, into new substances, that constitutes what is termed destructive distillation.

The products of this alteration present, in all cases, a general similarity. There is, in the first place, the carbonaceous residue, which cannot be volatilized—the "coal," as it was formerly called. Amongst the volatile products, water and oil are conspicuous; there are generally some substances dissolved in the water, communicating to it peculiar characters, according to the nature of the material distilled, and in all instances some gas is produced.

In the earlier days of chemistry the destructive distillation of organic substances was considered to effect a separation of their component parts; it was looked upon as a means of analysing both vegetable and animal substances. But it was found that the products of the destructive distillation of a substance varied in amount according to the heat applied to it, and, consequently, when quantitative relations became an important consideration in chemistry, this opinion was abandoned, and it has long since been generally admitted that the alteration such substances undergo in destructive distillation is greater than a mere separation of pre-existing components,—that it consists in an entire destruction of the original substance, with simultaneous production of new substances.

This decomposition of an organic substance by heat consists in a disturbance of the chemical equilibrium upon which its existence depends; the products to which it gives rise are substances capable of existing at the higher temperature. All organic substances are characterised by their liability to decomposition by heat, but they differ among each other very much in their capability of supporting heat, or, in other words, in their liability to decomposition under its influence. For every organic substance there is a particular range of temperature within which its existence is possible and beyond the higher limit of which it undergoes decomposition. Hence there is an intimate and essential connection between the nature of the products and the temperature of the decomposition, and it follows that the special nature of the products obtainable in destructive distillation differs, according to the temperature at which it is conducted, no less than according to the material from which they are obtained. These features of the decomposition of organic substances by heat, were very clearly recognised by Lavoisier; they received at his hands considerable attention, and though they did not occupy a prominent place in the chemical phenomena that, in his time, were the object of general interest, his works contain important discussions as to the causes to which they were referable.

Prior to the time when Lavoisier wrote on this subject, the product of destructive distillation to which—with some few exceptions which I shall afterwards notice—most attention was directed, was the oily product. The characters of the oil obtained by this means from different substances are often described in old chemical works. Sometimes it was called tar, that term being applied to those kinds of pyro-oils which were resinous and dried up by exposure to air, as in the case of that obtained from pine-wood, and which at the present time is still commonly known as tar. Some of these pyro-oils figure as medicinal agents in the pharmacopœia of 1678, and amongst others the oil of coal—which is described as a fossil bitumen, bearing the names of carbo petræ, lithanthrax, sea coal, or Newcastle coal—and the direction given is that "you may distil it as amber, so shall you have a spirit and oil." But this oil of coals soon became a matter of more extended observation, in consequence of the attempts made to use pit coal as fuel in smelting. For a long time these attempts were unsuccessful. At length, however, a method was found of removing the disadvantages of coal for smelting purposes. That method, as every one knows, was coking. The discovery of this method has been ascribed to Becher, who was in England

about the year 1665, but he says himself that it was a German, of the name of Blavesten, who first suggested the idea of employing what he called "stone charcoal" for smelting iron. In any case the oily product obtained from the coal, by heating it in close vessels, attracted the attention of Becher, and he put forward a project for making tar from coal, apparently in conjunction with the production of coke, which is very often referred to in old works, but always in very vague terms, and nothing much seems to have come of it.

The German chemist Neumann examined the oily products of the distillation of coal, and described them in his works as consisting of a "thin fluid oil" and another "thick pitchy oil." He obtained these by distilling the coal of Halle "with a fire gradually increased," and he states that "the coal, during the distillation, looked like melted pitch." Still these products were not turned to any useful purpose.

However, the coking of coal, or the desulphurizing, as it was sometimes called, became an important operation, and great interest was excited by it on the Continent. In 1765, the French Government thought it desirable to send a commission to this country, for the purpose of learning the art of coking. An account of their observations is given by M. Jars, the brother of one of the commissioners. He says:—"The English were the first to attempt rendering coal available for smelting purposes; the first trials are of a very remote date. And, among others, Swedenborg speaks of it as an art which in his time was not fully developed. But the industry of the English overcame all difficulties, and they succeeded, by means of very simple operations, in attaining the desired end, that is to say, in depriving pit-coal of the defects which render it unfit for smelting." The attempt to turn to account the volatile oily products obtained in coking coal was still continued, both in this country and on the Continent. At Liege, for instance, coal was distilled for oil, and similar attempts were made likewise in various parts of England, by the Marquis of Rockingham, near Sheffield, by a Dutchman named Van Haak, at Coalbrookdale and Newcastle, and by others.

One of the best known instances of the application of these volatile properties of coal, was one carried out in Nassau, shortly before the year 1768, at some iron works belonging to the Prince of Nassau-Saarbruck, at Sultzbach. This plan was described by M. Genssane to the French Académie des Sciences, and reported upon by Macquer. He says:—"The whole art of the preparation of pit-coal, so as to render it fit for smelting, consists in depriving it of the bituminous and sulphury substances which render it too fat and energetic when it is used in its natural state. * * * This principle once established, it is easy to conceive that it is only by distillation and evaporation that these two substances can be separated from the coal."

The distillation of coal at these works was conducted in a kind of close oven, or muffle, heated externally by furnaces. "The fire was got up gradually, until the oven became slightly red-hot, and it was then kept at that degree. * * * The heat being gradually communicated to the coal within the oven, first of all expelled its bituminous portion, which distilled off through a pipe, and fell into a receiver; when the coal had given off its bitumen, it commenced to become slightly red-hot.

"The oil and bitumen obtained in this operation almost paid the cost of it. * * The pure bitumen was very thick and greasy, and equal to the best carriage grease. * * The oil did not differ from that obtained by distilling petroleum, except in being much less readily inflammable than the latter, and it could be advantageously employed in lamps by the country people. Nothing else was used for burning in the mines at Sultzbach."

MM. Macquer and Montigny, in reporting to the Académie on this manufacture, speak highly of its utility, and when we consider the extent to which the manufacture of which this was the first germ, has now grown, it appears that their opinion was well founded.

The next person who made a step in this branch of manufacture was Lord Dundonald. The preparation of coke appears to have been still the predominating idea, but it was also thought that the volatile substances given off in this operation might be turned to account, as well as the coke. All the previous methods of obtaining these products consisted in distilling coal in close vessels heated externally, but Lord Dundonald's method consisted in partially burning the coal in a large chamber capable of being entirely closed, and admitting a regulated supply of air, just sufficient for maintaining the combustion of coal at the desired degree. The volatile products from the coal passed away through a pipe to a condenser, where they were collected. An account of the works erected on this plan, at Upper Cranston, is given in Sir John Sinclair's "Statistical Account of Scotland." The product obtained, besides coke, was a mixture of tar and water. This first product was submitted to distillation, yielding an oil lighter than water, and a solution of ammonia. This tar was sold for greasing cart wheels, at the rate of sixpence per Scotch pint. When the distillation was continued for 4½ days, the residue, remaining in the still, was the tar suitable for coating ships, which was regarded as one of the most important of the products. When the distillation was continued for 5½ days, the residue in the still was more pitchy; and after 6½ days it was quite brittle.

Just at the time when Lord Dundonald was carrying out his enterprise of coal distilling, the subject of destructive distillation was treated of by Bishop Watson, in one of his essays. He gives the results obtained by the distillation of pit coal, "with a fire gradually augmented," and describes one portion of the oil he thus obtained from Newcastle coal, as being lighter than water, "more or less liquid and transparent, according as the heat used in conducting the distillation has been greater or less."

Another portion of the oil was black, thick, and tenacious, much resembling tar. He also states that, "The quality of the liquid separable from wood by distillation is wholly the same as that of the liquid separable from pit coal by the same means."

He also adds that "it is probable that the quantity of oil separable from the same kind of coal by distillation may be influenced in some degree by the manner of performing the operation; and there is, moreover, some reason to believe that in different kinds of coal the quantities may be very various."

This conjecture was soon supported by results of observation. M. Sage, in a paper on coal, published in 1789, describes English cannel coal as yielding "by distillation more than one-third of its weight of oil that solidified in cooling," while the French coal gave only one-sixteenth of its weight of oil. Newcastle coal, though containing "as much bitumen as cannel coal," was described by the same observer as being very different from it, and Scotch coal, which contained much less bitumen than either of the preceding coals, gave by distillation an oil that was liquid and floated on water.

Kirwan, in 1796, stated that almost all species of mineral coal yield on distillation more or less of both species of bitumen—solid and liquid—but that "the proportion is variable in every species, according to the degree of heat applied." Referring to Lord Dundonald's method of obtaining tar from coal, he says—"By his lordship's mode of distillation, however, much seems to be lost during the internal combustion. I should think the Prince of Nassau-Saarbruck's method in this respect more advantageous. M. Sage tells us that by distillation he obtained from cannel coal one-third part of its weight of tar."

It is very interesting to find that Kirwan describes the coal used by Lord Dundonald for distillation as being a kind of cannel coal, similar to, but of a better sort than, the "stony or slaty cannel coal" from Ayrshire. This coal is described as burning like compact cannel coal, without caking, and leaving a stony residuum. It contained 20·83 per cent. of ash.

Proust also, in 1806, described the oils obtainable from coal by distillation: a light oil similar to that of amber, and a heavy oil like tar. He says that "the oily products of coal vary much in consistence, and it is necessary always to make an experiment to ascertain if it will yield thick oil or tar."

Lord Dundonald's method of distilling was carried out also in France by a M. Faujas de Sainte Fonds, who claimed to have conceived the same idea of obtaining the volatile products given off in coking, before knowing of Lord Dundonald's plan, although he was confirmed in that idea by visiting the tar works in Scotland. Shortly after his return to France an experiment was made by him, by the order of M. de Calonne, to illustrate the operation, and an account of it is given in a scientific journal of that time.

Just at this time, however, a circumstance took place which exercised a great influence on the development of this young branch of manufacture. The oil manufactured by Lord Dundonald was just beginning to be employed for street lamps, and it is said that he was in treaty with the authorities with a view to the lighting of London by means of it, when a new project was started, viz., the use of gas as a source of light, which eventually proved the overthrow of Lord Dundonald's undertaking.

The chemistry of gases, or pneumatic chemistry, as it was then termed, had, during the latter half of the 18th century, gradually absorbed the attention of chemists. As far back as 1721, Hales had, in the course of his experiments on air and its relation to vegetation, observed that Newcastle coal yielded in distillation one-third of its weight of air. In 1739 Mr. Clayton was induced, by the observation of a natural discharge of combustible gas from the neighbourhood of a coal pit, to try the effect of heat upon coal, and he found that by distillation he obtained a similar inflammable gas, together with a black oil and some watery liquid. This spirit of coals, as he called it, served him for the amusement of his friends, and for the entertainment of the Royal Society, but for no further purpose. In 1759, Neumann stated in his "Chemistry" that vegetable substances in general, urged hastily by a strong fire, emit an aerial elastic vapour. Bishop Watson also refers to the inflammable gas produced in distilling coal, etc. He says, "the products obtainable by distillation from bituminous and vegetable substances in general are water, gas, oils of different colours, weights, consistencies, and a black, coaly residuum." It was not, however, until shortly after the year 1790 that a Cornish engineer, Mr. Murdoch, not only observed that the gas given out by heating coal, wood, peat, &c, burnt with a bright luminous flame, but also conceived the idea of using the gas thus produced as a source of light. A somewhat similar idea was about the same time being carried out in France by Le Bon, the material from which gas was obtained being wood.

The announcement of this invention produced a most remarkable effect. Notwithstanding energetic opposition to its introduction, it rapidly gained ground; in 1810, the first Gas Light and Coke Company was formed, and ten years later gas was almost universally used in London.

Attention was thus suddenly diverted to the gaseous products of destructive distillation, as a source of light; but the oily products were not wholly forgotten, nor did the nature of the relations existing between them and the gaseous products admit of their being overlooked. Long before any great attention had been directed to the gaseous products of destructive distillation, it had been observed that both the quantity and the quality of the oily products obtained from any given material depended upon the degree of heat employed in the distillation. But when the gas produced in the distillation also became an object of investigation, and when the means of producing it for practical purposes were being developed, it soon became evident that, to a great extent, gas and tar or oil were convertible substances; that whenever a great deal of oil was produced only a small quantity of gas was obtained. This fact threw a new light upon the nature of destructive distillation, and since it was a most important desideratum, in regard to this new manufacture, to obtain the largest possible quantity of gas, the conditions requisite for effecting this object were specially investigated at a very early period in the history of gas lighting.

The general result arrived at was, that the production of the largest amount of illuminating gas from coal required the distillation of the coal to be conducted within a certain range of temperature. When the temperature was much below an ordinary red heat, a smaller quantity of gas was obtained than when the distillation was conducted at a full cherry-red heat, and at the same time a larger quantity of the oily product was obtained. On the other hand, when the temperature was much above a full cherry-red heat, the quantity of gas was much increased, but its illuminating quality was very much reduced. Hence a cherry-red heat was fixed upon as the temperature to be employed in practice, because that was the temperature at which the largest quantity of the volatile products were converted into the state of gas of the greatest illuminating power, and at which the smallest quantity of those products remained in the liquid state.

Accordingly, in practical and scientific works, treating of the manufacture of gas and the phenomena of destructive distillation generally, this fact is prominently mentioned. Thus, for instance, Accum says: "The production of carburetted hydrogen, both with regard to quantity and quality, from the same kind of coal, depends much upon the degree of temperature employed in the distillatory process. If the tar and oil produced during the evolution of the gas in its nascent state be made to come in contact with the sides of the red-hot retort, or, if it be made to pass through an iron cylinder or other vessel heated red-hot, a large portion becomes decomposed into carburetted hydrogen gas and olefiant gas, and thus a much larger quantity of gas is produced than would be obtained without such precaution, from the same quantity of coal." This was rendered still more evident by pointing out that every pound of coal tar so decomposed produced "15 cubic feet of carburetted hydrogen, abounding in olefiant gas."

Ure, in 1824, describing the theory and practice of the production and use of coal gas, says, "If coal be put into a cold retort and slowly exposed to heat, its bitumen is merely volatilized in the state of condensible tar; little gas, and that of inferior illuminating power, is produced. This distillatory temperature may be estimated at about 600 degs. or 700 degs. Fahr.

"If the retort be previously brought to a bright cherry red heat, then the coals, the instant after their introduction, yield a copious supply of good gas, and a moderate quantity of tarry and ammoniacal vapour."

Dumas, in 1828, describing the general features of destructive distillation, says that the nature of the products depends on the temperature employed. "By heating gradually, oil is produced, and at a higher temperature no oil is obtained, because it cannot exist at the higher temperature." Describing the manufacture of gas, he adds that the products obtainable from coal by distillation are "coke, tar or oil, and gas." The relative quantities of each of these products are very different, not only according to the different kinds of coal, but still more according to the temperature at which the decomposition is effected. Experience has shown that the quantity of oil or tar, as well as that of coke is greater when the temperature is low; while these products are formed in less proportion when the temperature is high. The quantity of gas, on the contrary, is greater at a high temperature than at a low temperature, that is to say, the more gas is obtained, the less tar is produced. It is evident, therefore, that during the operation of gas making a suitable temperature must be maintained. If it is too low, a large quantity of tar is produced and little gas."

Hence it is evident, as I have before remarked, that

though attention was directed chiefly to the production of gas, the other product of destructive distillation, viz., the oil, was not forgotten, although it was not the desired object of the manufacture. And though gas had become the chief object of attention as a source of light, the production of oil, by destructive distillation, was not abandoned. So late as 1819, Waterloo-bridge was lighted with coal oil, and in the same year M. de Saussure published an account of a method of purifying hydrocarbon oil, obtained by the destructive distillation of a bituminous mineral found at Travers, in Neufchatel. That method is identical with those employed at the present time. But it was in 1833 that the first important impulse was given to this manufacture, by the investigations of Reichenbach into the chemical nature of the products obtained by the destructive distillation of organic substances. Up to that time the knowledge of the oily products of destructive distillation, in regard to their chemical nature and the means by which they might be purified, was very slender. It was known that different materials yielded different kinds of oily products, and that the quantity obtainable varied according to the nature of the material and the temperature of the distillation. Neumann described the oil first drawn in the distillation of organic substances by a fire slowly raised, as being commonly fluid and lighter than water, while that which followed, at a higher heat, was thick and heavy, and that forced out at last, by the "greatest vehemence of fire, assumed a pitchy substance." Accum described the tar from Newcastle coal as being specifically heavier than that produced by cannel coal; hence it sank in water, whereas the latter swam on the surface of water.

The tar obtained in gas-works required to be boiled down to give it a sufficient consistence, and render it fit for use in coating wood. When this process was conducted in close vessels, a portion of oil was obtained that was commonly known as oil of tar, and by carrying on the distillation still further, more oil was obtained and a residue of pitch. The crude tar gave about 25 per cent. of the first-named oil, and by further distillation about 47 per cent. of pitch. No great use was made of these oils however, and, as is still the practice, gas tar was often boiled down in an open vessel without attempting to collect the oil.

While things stood thus, Reichenbach's first paper appeared. He referred to the oily products of destructive distillation as substances that had hitherto received but little attention from chemists, partly in consequence of their having been rare, and partly because those that were known, possessed characters that prevented their being applied to practical purposes; thus, for instance, their use as illuminating materials was prevented by their copious production of smoke when burnt; by their too great inflammability or liability to alteration when exposed to the air, their offensive smell, and several similar obstacles. He therefore considered that a more complete investigation of these products was desirable, and the thorough practical spirit in which he undertook this investigation is apparent throughout his memoirs.

The first substance which he succeeded in obtaining from tar was paraffin. That substance is now too well-known to need a repetition of his description of it. I need only mention that he described it as existing in tar in considerable quantities. He pointed out that the application of tar as a material for greasing the axles of cart-wheels depended upon the presence of this substance in tar, and that it was likely to furnish an appropriate material for making candles. He showed, also, that its peculiar chemical stability, under the influence of powerful re-agents, was such as to suggest various easy means of extracting it from tar on a manufacturing scale. He then adds:—"I have here spoken only of the tar of beech-wood; however, it is not only in this, but also in the tar of pine-wood, that I have ascertained the existence of paraffin, and there is no doubt that it is produced by the distillation of all kinds of wood." Shortly afterwards he obtained paraffin by distilling animal substances. This led him to the conclusion that paraffin is a product of the carbonisation of all organic substances, and he then extended his investigation to mineral substances, principally coal. By distilling coal in an iron retort, "commencing the distillation at first with a gentle heat, then gradually raising it, till at last the bottom of the retort was made dull red-hot, and then cherry red," he obtained an oil containing paraffin, and then pronounced paraffin to be a common product of all substances of organic origin.

The next substance which he succeeded in obtaining from tar was a liquid oil, to which he gave the name of eupion. This oil he also found to be a product of the carbonisation of coal and all organic substances. While paraffin was obtained in least amount from the tar of coal, the liquid oil was obtained in larger amount from this tar than from any other. The oil to which he gave the name of eupion does not appear to have been a distinct chemical substance, but it was perfectly analogous, if not identical, with the hydro-carbon oils now used for burning in lamps, except that it was very much more highly refined than those oils are in practice.

Referring to the possible application of this oil, Reichenbach says, "If it should hereafter be possible to separate eupion from tar sufficiently cheaply, it is probable that it may be applied to useful purposes; for, since it burns brilliantly, without smoke, by means of a wick, it is suitable as an illuminating material, not inferior to the finest oil; it does not grease, nor char the wick, nor thicken by keeping, nor solidify in the cold. Besides this it is not requisite for any applications in which the oil is not exposed to cold, that the paraffin should be separated from it."

At the conclusion of his first memoir, Reichenbach expressed the hope that the oily substances obtainable by destructive distillation might, from a scientific point of view, receive more attention than they had hitherto, especially since one of them, paraffin, had been ascertained to exist in such abundant quantity in tar, to be capable of being introduced into industrial economy, and to possess characters that would render its extraction easy.

Just at the very time that Reichenbach discovered paraffine, and ascertained that it was a general product of destructive distillation, the same substance was obtained from the native petroleum of Rangoon by Dr. Christison, of Edinburgh. He gave it the name of petroline in the first instance, but subsequently recognised it to be the same substance as Reichenbach had produced by destructive distillation of organic substances and coal. Dr. Christison also obtained four different kinds of oil from Rangoon petroleum, different in colour, boiling point, &c.

The most important part of Reichenbach's memoirs consists in the very thorough elucidation they give of the phenomena of destructive distillation, as regards the oily products of that operation. It was to these oily products that his attention was exclusively directed, and in the incidental notice he had occasion to take of gas making, he showed very clearly that the conditions which give rise to the production of gas are very different from, and indeed the opposite of, those which determine the formation of oily products.

In describing the general character of tar, or the oily product of destructive distillation, he says:—"Tar is not a uniform or definite material, but a mixture of various constituents, which differs according to circumstances. All carbonisable substances yield tar, but the tar is of different kinds, according to the nature of the material it is produced from.

"Moreover, tar varies in its character, according as it is produced under absolute or partial exclusion of air, according as it is produced in one or other kind of vessel; * * * it is one thing when it is produced slowly, and another when it is produced rapidly; it is different at the beginning and the end of the carbonisation. When the carbonising heat is high, the tar produced is different from that produced when the carbonisation is conducted

within the limits of a moderate temperature." He showed that, as a general rule, the production of tar, consisting of oil and paraffin, depends upon the application of a moderate heat, only just sufficient to carbonise the substance operated upon. In treating of the distillation of coal, he especially pointed out that this was the condition most essential for obtaining tar containing oil and paraffin, that by conducting the distillation of coal so as never to allow the retort to become red-hot, he always obtained tar containing eupion, paraffin, and creosote. This was what he termed a "pure tar of carbonisation," and to obtain such tar he particularly stated that it should not, at any stage of its formation, be exposed to a higher heat than that sufficient for carbonisation. The tar produced at a high temperature, on the contrary, he showed to be entirely different in its nature, whether obtained from coal or any other material. In the first place, it did not yield by re-distillation, more than half as much oil as pure tar, and it contained substances which were never present in pure tar obtained at a low temperature. These substances were naphthalin, pitch, and soot, and the tar obtained from coal in the manufacture of gas was found to be of this kind; it was not a pure tar of carbonisation, but an impure mixture. The circumstances which gave rise to this great difference between the tar obtained at different temperatures were ascertained and very clearly described. It was shown that naphthalin was not a product of carbonization; that while mere carbonization yielded only oily products, naphthalin was produced by the further decomposition of those products under the influence of a higher temperature—that it was a secondary product—and it was shown that the operation of gas-making did not admit of simple carbonization, since a bright red heat was necessary for producing gas. For this reason the tar of gas-works was black and thick and contained naphthalin, because the oil vapours, produced from the coal in the first instance, came in contact with the sides of the red-hot retort and were thereby decomposed.

Considerable prominence was given to this important difference between the tar produced from coal, at high and low temperatures, in consequence of an opinion expressed by Dumas that naphthalin was a direct product of the distillation of coal, and of the conjecture founded on that opinion that naphthalin existed in coal. This led to the repetition of Reichenbach's experiments, and to the publication of a memoir in which he satisfactorily showed that coal did not contain naphthalin, and that coal tar did not contain it unless it had been submitted to a high temperature and partially decomposed. Reichenbach showed, moreover, that naphthalin was obtainable in like manner from the tar of wood, from alcohol, ether, naphtha, and probably even from olefiant gas by exposing these substances to a bright red heat. The accuracy of these observations was recognised by Dumas, who quoted them in his treatise. The general results of these investigations were, that the production of oily substances by destructive distillation was essentially dependent upon the application of a moderate degree of heat; that the constant products of this operation were eupion and paraffin, together with some others that have not yet been turned to account.

Attempts were soon made to apply the knowledge thus obtained for practical purposes. Materials were sought for that would yield oil and paraffin in sufficient quantity to admit of their being worked. The ordinary coal, then in general use, yielded too little of these products, and the first material to which attention was directed was bituminous schist or shale. A variety of this mineral occurring at Vouvant, between Nantes and Rochelle, was examined by Dumas, and found to yield 14 per cent. of oil, and works were established about the year 1830 for the purpose of manufacturing oil from it by M. Selligue. The crude oil obtained from it is described by Dumas as being greenish-brown and solidifying when cooled in consequence of containing 2 or 3 per cent. of paraffin. He also pointed out the applications to which these products might be turned as a source of light both by burning in lamps and making gas.

Very shortly after this M. Laurent, who had visited the neighbourhood of Autun and suggested the manufacture of these oils, published an account of an English schist that had been sent him for examination and which he found to yield 20 per cent. of oil by distillation at a low temperature, finally raised to a red heat. In 1833, a patent was taken out in this country by Richard Butler for the manufacture of oil and gas, from bituminous shale, which consisted in an application of the results obtained by Reichenbach, and of the principles he had laid down with regard to destructive distillation. The specification of this patent is interesting from its containing the earliest mention of paraffin, as the product of a manufacturing operation. It is stated that the less volatile portion of the oil, obtained by distillation below a red heat, contained a white colourless substance—a compound of carbon and hydrogen, which separated in small flakes when the oil was cooled. The claim in this specification is for "the production of oils, by distillation or carbonization, from bituminous schistus or shale, and slate, not including slate coal and bituminous sandstone;" and for "the production of gas for illuminating purposes from such oils, or direct from the bituminous schistus or shale, and slate, &c." For the direct production of gas it is directed that "the retorts should immediately be brought to a red heat," while on the contrary, the heat was to be gradually applied when the object was to obtain oil in the place of gas. It is interesting here to notice, that the main principle of distillation at a low temperature for the purpose of obtaining oils, was fully recognised and applied in the method proposed by Butler, as well as in all subsequent proposals in reference to this manufacture, still the influence of Dumas' authority was recognizably exercised, in this instance, in regard to the exclusion of coal. This, the patentee states, was not to be used because it yielded tar containing naphthalin. That influence is recognizable even at a later period, notwithstanding the fact that in 1835, Dumas had quoted Reichenbach's results as being contradictory of the opinion he had formerly expressed, that naphthalin either existed in coal, or was a product of its distillation. It is worth remark, also, that it is uncertain to whom this opinion is due, for M. Dumas, in 1832, ascribes it to Laurent, while Laurent writing at the same time ascribes it to Dumas, and Oppermann, also at the same time, says that Reichenbach has decisively proved that naphthalin is produced only by the destruction of the oils by a high degree of heat.

Another patent for a method of effecting the same object was taken out in 1831 by Mollerat.

In 1841, a patent was taken out by Hompesh for "improvements in obtaining oils and other products from bituminous matters, and in purifying and rectifying oils obtained from such matters. The objects of these improvements were to obtain a larger quantity of oil, and to improve its quality by removing or greatly modifying the disagreeable smell. The former object was sought to be obtained by a special arrangement devised for very gradually increasing the heat in the distillation of the shale and consequently preventing the decomposition of the oil vapour produced. The means of attaining the second object consisted merely in an amplification of the method already made known by de Saussure for the purification of hydrocarbon oils.

Another patent was obtained in 1845 by Du Buisson, for "New and improved methods for the distillation of bituminous schist and other bituminous substances, as well as for the purification, rectification, and preparation necessary for the employment of the productions obtained by such distillation for various useful purposes." In his specification he says, that though many attempts had been made in England to render bituminous shale useful, they had all failed, while the most important results had been obtained at the works near Autun. His method of treatment consisted in a further application of the principle

of distillation at a low temperature, so as to obtain the largest yield of oily products, and to prevent their decomposition into gas by the influence of too high a temperature on this vapour. He proposed to effect this by introducing into the retorts, steam heated by passing it through red-hot pipes, so as to sweep out the oil vapours, and at the same time to admit of the distillation being completed at the lowest possible temperature. The retorts were to be heated externally as before, but the steam introduced was not under pressure, so that while equalizing the temperature of the shale under distillation, and acting mechanically in removing the oil vapours it also kept the temperature from rising so high as to convert them into gas.

About the year 1845, works were erected at Beul, on the Rhine, for the manufacture of oils and paraffin from a mineral that occurs there. It is an imperfect coal, generally known by the name of "brown coal." These works have been in operation since that time to the present.

In speaking of the practical applications of the products of destructive distillation, I must not omit to mention the patent obtained by Mr. Mansfield, in 1847, for "An improvement in the manufacture and purification of spirituous substances and oils, applicable to the purposes of artificial light, and various useful arts, and in the application thereof to such purposes, and in the construction of lamps and burners applicable to the combustion of such substances." This is described in the specification to consist—

1st. In methods of separating the oils and spirituous substances contained in tar, or oils distilled from any kind of coal, either in the manufacture of gas, or by any other process of destructive distillation of coal.

2nd. In methods of purifying volatile bituminous oils found native, or produced by destructive distillation.

3rd. An improved application of the products, thus obtained and purified, to the purposes of artificial illumination, by reducing the proportion of carbon in the flame produced by burning them.

The method adopted by Mr. Mansfield for separating the constituents of tar, was to collect, in fractional portions, the oil distilled off at different temperatures. The purification of the products thus obtained was to be effected much in the same manner as that described by De Saussure, by Reichenbach, and in the specifications already mentioned. The reduction of the proportion of carbon in the flame of the oils from tar, was effected either by mixing them with other combustible liquids containing a smaller amount of carbon and more oxygen, or by mixing them with a gas containing less carbon, or none at all, such as carbonic oxide, or atmospheric air. For this latter purpose the most volatile portions of the oils obtained from tar were employed.

Further attempts were made in this country to work the bituminous shale of Kimmeridge and Wareham, and also to manufacture oil from peat, under a patent obtained by M. Reece in 1848, but no results of any advantageous nature were obtained in either case.

The cause of these failures to establish in this country the manufacture of the products which had been found profitable on the Continent, was twofold. In the first place, the general introduction of gas lighting limited the possible demand there might otherwise have been for an improved illuminating material; and, in the second place, the materials operated upon yielded the oil in such small proportion, and, frequently, of such an offensive character, that it was found impossible to introduce it into use for lamps, or to manufacture it profitably for other purposes.

But, on the Continent, the oil-yielding materials worked there, though not much more productive than those in this country, furnished oil of a less objectionable character, and more easily purified. Moreover, as gas was little used, there was a wider field for the introduction of this oil as an illuminating material. It rapidly came into use, and several manufactories were established for its production in various parts of Germany. It was there that the manufacture was perfected, and that the demand for these products of distillation was first established.

The next step in order of time was in the year 1850, when a patent was obtained by **Mr. W. B. Stones** for "Improvements in treating peat and other carbonaceous and ligneous matters so as to obtain products therefrom." These improvements are described in the specification to consist in distilling "shale, stone-coal, cannel coal, and other coals, petroleum, asphaltum, &c.," so as to extract from them oil and paraffine, and in methods of separating and purifying these substances. The distillation was to be effected in closed vessels, not heated externally, but by means of steam heated to a sufficient temperature to carry off the products in a state of vapour. Shortly afterwards, in the same year, a patent **was obtained by** Mr. James Young, for "Improvements in the treatment of certain bituminous mineral substances, and in obtaining paraffin therefrom." These improvements are described in the specification to consist in gradually heating the coal up to a low red heat, at which it is to be kept until volatile products cease to come off, care being taken to keep the temperature from rising above that of a low red heat, to prevent as much as possible the desired products of the process being converted into permanent gas. The product so obtained was described as oil containing paraffin, and was hence called paraffin oil. Methods of separating this product into various useful commodities, and of purifying them, were also described in the specification.

In the Exhibition of 1851, specimens of paraffin and other products obtained by the distillation of peat, shale, coal, and bitumen, were exhibited, and in the Jury Report it is stated that "the condensible products from the distillation of coal and other bituminous products are becoming every day more important," the value of these products for lubricating purposes being especially pointed out.

At that time the only hydrocarbon oil used in this country as an illuminating material was camphine—a very highly refined spirit of turpentine. Though the hydrocarbon oils obtained by destructive distillation were largely used on the Continent for burning in lamps, they had not come into use for that purpose here, and were not so used until several years afterwards. But success had been attained in the application of hydrocarbon oils from another source and in a different direction. The intimate connection and similarity between the oily products of destructive distillation, and mineral oils, such as petroleum, found in many places, had long been recognized in a general way, and was described in most chemical works.

Dr. Christison had shown that this resemblance extended beyond the mere outward character of these materials by the extraction of paraffin and various oils from the petroleum of Rangoon, and various other chemists had added to the knowledge of these native oils. In 1847, about the time Mansfield's patent was taken out, petroleum was discovered in a coal mine in Derbyshire, and Dr. Lyon Playfair drew the attention of Mr. James Young to it, the consequence of which was that he took a lease of the petroleum spring in conjunction with Mr. Meldum, and established a manufacture of lubricating oil from this material. This was the first successful application in this country of hydrocarbon oils, and the first instance of the realization, in this country, of Reichenbach's prediction that these materials would become useful as soon as they could be obtained in adequate quantities and at a sufficiently low cost.

I have already referred to the small quantity of oil yielded by the bituminous shales, as having been one of the main causes of failure in the attempt to establish the manufacture of hydro-carbon oils, and, as the respective capabilities of various materials in this particular, is still one of the most important circumstances connected with their application, it is desirable to refer to this point more fully.

The different varieties of bituminous minerals, including bitumens, shale, and coal of all kinds, vary very con-

siderably in the amount of volatilisable substance they yield when heated in a close vessel. This character is one in which these minerals present greater differences than in any other. Even in the case of coal the differences are considerable. The results obtained in gas making may be taken as an indication of this fact.

	Newcastle.	Derbyshire deep main.	Wigan.	Ramsays.	Wemyss.	Lesmahago.	Boghead.
Coke	1,494	1,335	1,326	1,435	1,156	1,077	710
Volatile: Gas	291	300	338	410	539	473	749
Volatile: Tar	135	219	250	295	210	600	780
Volatile: Water & loss.	320	386	326	100	435	90	1
Volatile	746	905	914	805	1,184	1,163	1,530
	2,240	2,240	2,240	2,240	2,240	2,240	2,240

It is evident from this table that the bituminous portions of different coals differ very much in regard to the amount of volatilisable substances they are capable of yielding by distillation. But this difference is greater than it appears to be from the above table, on account of the differences in the amount of ash contained in coal. Boghead contains 22 per cent., Newcastle only 3 per cent., and when this is deducted, the true relation between the volatilisable and fixed portion of the bituminous part of the coal becomes apparent.

	Newcastle.	Birtley.	Lancashire.	Derbyshire.	Wigan.	Lesmahago.	Albertite.	Shale.	Boghead.	Shale.
Fixed carbon	69	63	60	59	55	42	33	20	12	5
Volatile	31	37	40	41	45	58	67	80	88	95

Then comparing the amount of oil produced from coal by distillation at high and low temperatures, it appears that the differences in this respect are not by any means so important as the differences between the amounts of oil from different materials.

	Newcastle Coal.		Boghead Mineral	
	Bright red heat.	Low red heat.	Low red heat.	Bright red heat.
	lbs.	lbs.	lbs.	lbs.
Coke	1,494	1,544	...	710
Tar	135	274	936	780
Gas	291	252	...	749
Water & Loss	320	170	...	1

It is not only in regard to the quantity of oily product obtainable by destructive distillation that there are differences between bituminous minerals. The nature of the products so obtained is also very different. The oil obtained by distilling Newcastle coal is very different in its characters from that obtained by the similar treatment of the better kinds of cannel coal, bituminous shale, brown coal, &c.

It was, therefore, a very fortunate circumstance that, just at the period when the use of hydrocarbon oils for lubricating purposes was becoming established in this country, a new material was discovered at Boghead, near Edinburgh, which possessed, in a most remarkable, and then unparalleled degree, the capability of yielding, in great abundance, oil of such a nature as to be suitable for this manufacture. The discovery of this mineral just at this time was rendered more especially important from the circumstance that while the application of hydrocarbon oils was extending, the petroleum spring which was, in this country, the only source of these oils, was rapidly becoming exhausted. The ordinary kind of bituminous shale had been found unsuited for the purpose, and the manufacture was for some time likely to cease, when the discovery of this new mineral entirely altered the prospects of the manufacture. Works were established near the place where it was found, and the production of oil was soon carried out extensively. After a few years it was introduced, in this country, as an illuminating material, and since the year 1858 its use for that purpose has become very general.

About the year 1853, the manufacture of hydrocarbon oils and paraffin from Rangoon petroleum was commenced, and the burning oil obtained from it, and sold under the name of Belmontine, was the best oil of this kind yet manufactured. It was, however, high-priced, and the introduction of American petroleum appears to have caused it to disappear.

The superior excellence of the Boghead mineral, above all others, as an oil-yielding material, led to its being largely exported for the manufacture of oils, not only to the Continent but also to America, and for a time it was almost the only material used for the purpose. In America, however, other oil-yielding materials were soon afterwards discovered, which, if not equal to that of Boghead, were sufficiently productive to be worked there in its place, and not long after these materials had been in use the copious sources of native petroleum in various parts of America were discovered. This discovery has within the last two years produced a wonderful extension in the use of hydrocarbon oils, but, although, according to the latest accounts, the importation of petroleum into Liverpool during the last four months amounted to 2,000,000 gallons, more than twenty times as much as was imported during the same period in 1862, still the supply is not in excess of the demand, and the production of hydrocarbon oils by destructive distillation has not been stopped by the supply derived from this novel source.

The other products of destructive distillation are, for the most part, merely accessory products, and therefore do not require any special consideration. Among them are acetic acid, creosote, and wood naphtha, obtained in the manufacture of wood charcoal. Ammonia is produced in the manufacture of illuminating gas, in small amount, but in such considerable gross quantity, that this has long been the only source of ammonia and its salts, which are now so much more largely consumed than formerly, both as manures and in chemical manufactures. The oil known as "dead oil," and sometimes as "creosote," though different from the creosote of wood, is largely employed as a preservative of timber. The naphtha extracted from the coal-tar of gas works, in preparing this "dead oil," was formerly much used in the manufacture of waterproof cloth, but has now found a more profitable application in the production of the brilliant dyes that have lately been introduced under the names of mauve,

magenta, &c. The technical history of these dyes has lately been so ably described before the Society, that I can do no more than name these important materials, as being essentially products of destructive distillation, to illustrate the importance of this comparatively new art.

There is, however, one point with regard to the introduction of these dyes to which I cannot omit to refer. The immediate source from which these dyes are derived is a substance called aniline. This substance has been known to chemists for upwards of thirty years, and has been the subject of several elaborate investigations. It was first obtained from coal-tar. But though aniline was well known to chemists, and though another of its early sources was, singularly enough, indigo, no idea seems to have been entertained of its becoming of industrial value, or of its capability of yielding dye substances. It was indeed an extremely rare substance, and prior to 1854 was obtainable only in very small quantities. In the course of that year, however, M. Bechamp, a French chemist, ascertained that a substance derived from the light naphtha of coal-gas tar, was capable of being converted into aniline by a very easy operation. This circumstance, affording the means of obtaining aniline abundantly, together with the scientific interest that aniline had been shown by Dr. Hofmann to possess, appears to have led him, and other chemists, to make it the subject of their study. In the course of these investigations, it was observed, by Dr. Natanson in 1856, that a yellowish-red substance was obtainable from aniline by the action of elayl chloride. This substance does not appear to have been susceptible of application as a dye, nor the observation to have been regarded as having any practical significance. In the same year, however, Mr. Perkin, one of Dr. Hofmann's pupils, also studying the chemistry of aniline, happened to obtain from it a product possessing a rich violet or purple colour, which he soon found applicable in dyeing, and for the preparation of which he took out a patent shortly afterwards.

In 1858, Dr. Hofmann observed that by the action of a carbon chloride on aniline, a magnificent crimson-coloured substance was produced, but no reference was made to its technical applications. These two observations were the starting-points of the aniline dye manufacture, which has now acquired such gigantic proportions.

My object, in thus tracing the origin and history of this industry, is, by comparing it with the history and origin of the other industrial arts, connected with destructive distillation, to illustrate the progress that has taken place in the application of science to arts, and the advantages resulting from the increased facilities now existing for that application. Six years ago, it was first observed that a dye could be prepared from aniline. Six years ago aniline was a curiosity, unknown to any but those familiar with the more abstruse departments of chemistry. Now, in consequence of that observation, it is made by tons.

The case is very different with the hydro-carbon oils that are now so largely used as a source of light. To go no further back than the date of Reichenbach's elucidation of the nature of the substances produced by destructive distillation, of the conditions under which they were obtained, and of the uses to which they might be applied, it appears that the results which he obtained and placed at the disposal of all, slept unproductively and unused for near 20 years after that time; and for some three parts of a century since the same materials were used, in a crude condition, for lighting the mines of Sultzbach. It is true, the absence of a material that would furnish the oil and the paraffin in sufficient abundance, may have been one reason why the results of Reichenbach's researches were not sooner turned to useful account, in the way he suggested. But in the case of coal gas there was no such obstacle. Coal was everywhere used, and abundant. The fact that illuminating gas was obtainable in large quantity from coal by distillation, was known as far back as 1739, at least, but, for upwards of 50 years, no one conceived the idea of using that gas as a source of light. I believe the most important obstacles to the earlier application of these facts to have consisted, partly in the want of sufficient appreciation of scientific results by manufacturers generally, and partly, perhaps to a greater extent, in the tendency of chemists, according to the fashion of that time, to regard the results of research too exclusively in an abstract light, and as curiosities for the entertainment of a privileged few. This fashion is fortunately antiquated, if it be not extinct, and the rapidity with which the acquisitions of science now pass into the wider sphere of practical application, affords good ground for the conclusion that the more intimate relation existing between practice and science is both wholesome and beneficial.

DISCUSSION.

Mr. WENTWORTH L. SCOTT (responding to the invitation of the Chairman) said he believed, as regarded the destructive distillation of coal, Boyle was the first to hint at the existence of spirit in coal. In the statistical part of the paper, it was stated that during the last four months of the present year the importation of petroleum oil from America amounted to two million gallons. He believed those figures fell considerably short of the actual amount imported. According to the returns of Mr. Wormald, of Liverpool, the quantity imported during the whole year of 1861 was 1,492,473 gallons, and in 1862, 10,625,568 gallons. He, therefore, thought there was some error in the figures given in the paper, and he believed the quantity of petroleum oil imported during the last four months was double that stated. Mr. Paul had alluded to Charles Mansfield, who might be regarded as a martyr to the new science of destructive distillation, but it might be further remarked that he was the first person to propose what was now called the carburation of gas to increase its illuminating qualities. The proposed cylinders or vessels, through which the gas passed, were filled with small portions of pumice-stone or other porous material soaked with benzole; and the question had been raised whether some recent patents had not been invalidated by Mansfield. Looking at the comprehensive title of the paper he (Mr. Scott) confessed to a slight feeling of disappointment that it had not given some indication of what might probably be done in future, not only in the distillation of coal, but also of other organic substances. Waste products had been a favourite subject amongst many members of the Society, though they had been treated of as yet in an imperfect manner; both as to coal, and animal and vegetable products, of which imperfect use was now made, the whole question was yet in its infancy. Although the effects of different temperatures upon the same, and different descriptions of coal, had been stated in a general way, it was very important that the results of these various experiments should be carefully tabulated, and also that the effect of distilling coal mixed with other substances of a similar nature in different atmospheres should be investigated. He might mention, that on examining some shale from Ireland, with a view to its commercial utilization, and also another material more closely resembling coal, he found that when distilled separately they had something of the same properties as shale or coal of bad quality, but when mixed together, the products were different and more valuable. The effect of the mixture of coal and shale was very remarkable. Then, again, there were many instances in manufactures in which what might be called destructive distillation was carried on in such a manner that the products were entirely wasted, as was illustrated in the ordinary mode of burning bricks in an open kiln. The products in that operation were peculiar, differing from many others, and might be collected with great advantage. Other products of a different character were also worth attention. The refuse of towns, under destructive distillation, if arrangements for conducting the process could be cheaply effected, would afford a great source of profit.

The CHAIRMAN said, in the absence of further remarks upon this subject, it became his agreeable duty to move that the thanks of the meeting be given to Mr. Paul, to whom they were much indebted for the excellent paper with which he had favoured them. It was generally the endeavour of the Council that gentlemen occupying the position he had to sustain this evening should be conversant with the particular subject brought before the meeting, but, unfortunately, his friend Mr. Hawes, who was to have presided on this occasion, was prevented by illness from doing so. The subject generally was one with which he (the Chairman) was not familiar, but there was one portion of it in which he felt a special interest, viz., the manufacture of gas from coal. He could, from personal recollection, follow Mr. Paul in his history of the introduction of that important manufacture. He recollected the state of London forty or fifty years ago, when the streets were lighted with bad oil lamps, and afterwards, when the late Lord Dundonald introduced that important modification which Mr. Paul had referred to, and which for some time, though only for a short period, seemed likely to be a profitable investment of his talent and capital. Unfortunately for his lordship, but fortunately for the public at large, the application of coal gas was discovered, with what extraordinary results they all knew. Having referred to the excitement which was occasioned by the exhibition of the first experiments in street lighting by gas in Pall-mall, and at a chemist's at the corner of the Albany, in Piccadilly, the Chairman went on to remark that he had been for many years connected, as a director, with a gas company in this country which supplied six places in France; he therefore felt considerable interest in the portion of the paper which referred to that subject. A few weeks since Professor Ansted read a very able paper before this Society, in which he drew attention to many materials out of which gas might be produced; but it did not fall within the province of Mr. Paul to go much into detail on that part of the subject. With respect to the introduction of gas into France, it seemed singular, considering the large number of eminent chemists there, that they should have allowed a company in this country to invest capital for the purpose of supplying gas to towns in France; but so it was, and he was happy to say that it was not a bad investment. How far the existing vested interests in gas were likely to be interfered with by new discoveries in the production of artificial light, it was impossible for him to say. He did, however, know that scientific men had directed their attention to that subject, and he had a strong disposition to believe that some of them were likely to succeed. He had recently been present at some striking experiments in this direction, and as far as he was able to judge from what he then saw, and from the opinion of more competent authorities, it would seem as if they were on the eve of some very important discoveries in connection with artificial lighting. There had also been another element of disturbance recently introduced —he alluded to the electric light—which was now being experimented upon for lighthouse purposes at Dungeness, and the success of which seemed highly probable. These were questions which time alone would solve, but he thought it was only fair to expect that the electric light, which obviously possessed great advantages, might sooner or later be a very valuable addition to the many other sources of artificial light. With respect to the paper read this evening, he was sure all would agree that it contained interesting matter, and they must feel indebted to Mr. Paul for the able and elaborate way in which he had brought before them the results of the investigations he had made into the whole subject, and he (the Chairman) was quite sure the meeting would allow him in their name to present their thanks to Mr. Paul for his paper.

The vote of thanks having been passed,

Mr. PAUL, in acknowledging the compliment paid to him, said with regard to the quantities of petroleum oil imported into this country, his figures were based upon the authority of Mr. Macrea, who was largely engaged in that trade. Beyond that he could not vouch for the accuracy of the figures, and he stood corrected in that respect. With regard to the application of distillation to waste products, he had purposely avoided entering into that subject, because it was an open question. A great many waste products had been tried, but no results had ever been arrived at which he considered justified the treatment of the subject before this Society. Spent tan had been frequently tried, and, in one instance, on a large scale, for the purpose of making gas, charcoal, and other products, but no satisfactory results had been obtained from it, and for that reason he had avoided referring to it. With regard to the remarks of the Chairman as to the improvements that were likely to take place in the production of gas from coal and other materials, he quite agreed with that gentleman in the anticipation that very great improvements would be effected, and he did so from a very strong conviction that the present manufacture of gas, though very successful, was carried on in a way that was defective, and was capable of advantageous modification. The material used was abundant, and one of the products, coke, was so valuable that the manufacture of gas might even be looked upon as subordinate to it, and there was not so much attention paid to the quality of the gas as would be the case if it were of more exclusive importance in the manufacture. The use of petroleum oil as a gas-producing material was likely to be adopted. In Canada it was already largely used as a source of gas, and very probably in the same way that the richer cannel coal, that a few years ago was looked upon with aversion by the gas manufacturer, had now become one of the most important materials in the production of that article—so petroleum, he had no doubt, would soon obtain importance in the manufacture of gas; and if so, the road to improvement in quality would be more easy than it was at present, when gas was produced from coal.

The SECRETARY announced that on Wednesday evening next, the 3rd of June, an Extra Meeting would be held, when a paper by Mr. William Hawes, "On the Results of the International Exhibition of 1862," would be read. On this evening His Royal Highness the Duke of Cambridge, K.G., will preside. On this occasion members will only introduce one friend.

KING'S COLLEGE EVENING CLASSES.

The distribution of prizes and certificates in the department of Evening Classes, in connection with King's College, took place on the 20th instant, under the presidency of the Right Hon. W. E. Gladstone, M.P., the Chancellor of the Exchequer.

The Rev. Dr. JELF opened the proceedings.

The Rev. E. H. PLUMPTRE, the Dean of the College, said the Evening Classes were established in 1855. Their object was to meet the wants of young men in the offices and warehouses of this great City, who desired to spend their leisure hours in improving their minds and strengthening their character. The class opened with only five matriculated students—increased to seven and fifteen in the two following years. At the end of the three years they determined to admit them to the privileges of the College, and in 1858 the number of matriculated students rose to 104, but since then there had been a slight deflection in the number. On the other hand, there were the non-matriculated students. They began with 177 of those students, and in the years following the numbers were respectively 177, 147, 323, 445, and 555; but last winter there was a downward tendency, in consequence of the general commercial depression, the number being 523. Altogether, however, the number of students attending the evening classes last winter was 604, and they included members whose ages varied from 14 to 45, and even 50.

After specifying the different branches of knowledge taught, the rev. gentleman said that an important feature of the classes introduced this session was—that schools, with a large number of students, were allowed to enter and form a separate class, and to have special examinations. Of this privilege, Dr. Yeats, of the Upper and Middle Schools at Peckham, had availed himself, and as the result he would have the pleasure of introducing, for a certificate of honour, Mr. Edward M'Dermott, one of that gentleman's pupils, who had earned that mark of distinction in the division of "the principles of commerce."

The CHANCELLOR of the EXCHEQUER then proceeded to deliver the prizes and certificates to the successful competitors, addressing a few appropriate words of encouragement to each.

The following are the names of those to whom prizes and certificates of honour were awarded. Prizes and certificates of honour are of equal value, and are given to the student who stands first in the examination for each subject, provided he has gained at least three-fourths of the full number of marks. Those who received certificates of merit are omitted for want of space; these are given to all students who gain in the examination for each subject, at least three-fifths of the full number of marks:—

Divinity: — Henry William Atkinson, certificate of honour; Edward Stainton, prize; William David Ground, prize; William Farren, certificate of honour; George Galliers, prize. Latin:—George Galliers, prize; Henry William Atkinson, prize; Joseph Heptinstall Marshall, prize; George Butler, prize; James Golding, prize. Greek:—George Galliers, prize; James Bower, prize; Henry William Atkinson, prize; James Golding, prize. French:—Frank Bretherton, prize; James Robert Cole, prize; Francis Medland Phillips, prize; James Bretherton, certificate of honour; James Bower, prize; Frederick Heather, prize; Henry Wicks, prize. German:—Edward George Pearse, prize; Samuel B. Flaxman, prize; Henry Temple, prize; Thomas Adams Phillips, prize. Italian:—Edward Forbes Gaitskell, prize; Horace Hope Bloxham, prize. Spanish:—Llandaff Watson and Edward George, certificates of honour; Francis Medland Phillips, certificate of honour. English Literature:—George Butler, certificate of honour. English Composition:—George Galliers, prize; James Kirkwood, certificate of honour. Grammar and Composition:—William Honey, prize; Henry King, prize. History:—Walter Miller Taylor, prize. Geography:—Thomas William Green, prize. Mathematics: — Carlon John Lambert, prize; Frederick Joshua Whitworth, prize; William James Wood, certificate of honour; Edward Stainton, prize; James Bower, prize. Arithmetic and Book-keeping:—Stephen Henry Emmens, certificate of honour. The Principles of Commerce:—Llandaff Watson, prize, "On the best means of improving mercantile morals;" Frederick William Groves, prize; Edward M'Dermott, certificate of honour. Writing:—George Flack, prize. Chymistry:—Stephen Henry Emmens, prize. Mechanics;—William Fernie, prize. Experimental Physics:—John Simonet Scott, prize. Political Economy:—Joseph Heptinstall Marshall, prize. Logic:—Thomas de Courcy Atkins, certificate of honour; James Russell Tunks, prize. Physiology:—Robert Shakell Knight, prize. Drawing:—Arthur Debenham, prize. Botany:—Lewis Angell, certificate of merit. Zoology:—Arthur Pye Smith, certificate of merit; John Simonet Scott, certificate of merit; George Butler, certificate of merit.

Prizes to the five students who gained the highest aggregate number of marks in all the subjects respectively brought up for examination:—George Galliers, Divinity, Latin, Greek, English, History; Joseph H. Marshall, Divinity, Latin, Greek, Physiology, Political Economy; Francis M. Phillips, Divinity, French, Greek, German, Spanish; James Bower, Divinity, Latin, Greek, French, Mathematics; Thomas W. Green, Latin, German, Geography, Physics.

At the conclusion of the ceremony,

Dr. JELF expressed his thanks to the Rev. Mr. Plumptre and other professors and teachers who had assisted in conducting the classes.

On the motion of the Bishop of LICHFIELD, who was formerly Principal of King's College, seconded by Sir THOMAS PHILLIPS, a vote of thanks was passed by acclamation to the Chancellor of the Exchequer for his kindness in officiating on that occasion.

The CHANCELLOR of the EXCHEQUER said:—My Lord Bishop, ladies, and gentlemen, if it indeed were true that I have conferred upon you any remarkable favour by my presence, and by my share in the proceedings of this evening, I should have received much more than an adequate reward in the kind and cordial manner in which I have been welcomed among you; but, as the Bishop of Lichfield has very well observed, it has become almost a law of our political and social condition that those who are charged with the responsibility of public situations should from time to time take the opportunity of bringing themselves into contact, outside the walls of Parliament, with various classes of their fellow-countrymen. And permit me to say that I believe none are more willing to submit to that law than we, whose duties, whose habits, and whose privilege it is, as far as our limited opportunity allows, thus to seek occasion of meeting face to face those with whom we sympathise, and those with whom we desire to sympathise—those upon whose cultivated minds and intelligent convictions the Government of this free country in the main depends. For we feel that a great portion of the strength we may possess, of any capacity which may be accorded to us to serve our country, must depend upon our living and acting in the light of day, and upon our making ourselves thoroughly acquainted with the studies and the progress of mind and intelligence among our fellow-countrymen. It is a matter, in another view, of the greatest interest to me to come to King's College. In the first place, I never can forget how important has been the part which this institution has taken in the general movement of the age. Most of us think in this country that, whatever be the special designation under which we may be ranged by others, or under which we would like to range ourselves, the greatness and strength of England consist in reconciling and harmonising together what is old in our laws and institutions with what is new in the real demands and in the real civilisation of the time in which we live. If other countries have been less happy in their destiny—if they be precipitated upon violent and even bloody changes—if even these violent and bloody changes have failed for them to issue in stable order and extended freedom—it is because they have not had the secret of reconciling those various elements of their constitution and their condition; but they have come into violent collision one with another. In that work of reconciling and harmonising, which is the great characteristic of this country, King's College has borne a distinguished part. It was founded with one hand, as it were, laid upon the tradition of the past — upon the laws, the religion, and institutions of the country—and with the other hand pointing and beckoning onward, and announcing the intention of those who founded it and those by whom it was conducted to offer within its walls to the intelligence of their countrymen the means of meeting and satisfying every demand society was likely to make upon its resources. We have now, I venture to think, reached a time when it is no longer a question, so far as this institution is concerned, whether that reconciliation can be happily effected. I know that much has been due to the labours of the excellent Principal who now so worthily occupies that place—I know that much has been due to the ability, self denying zeal, and unwearied assiduity of the teachers and professors of this College; but not even these powerful agencies would have availed to effect the results which have been actually achieved unless the principle had been sound, and unless the plan of the College had been found to combine a just

relation to practical experience. But I must say that to those who occupy positions such as that which I unworthily fill, opportunities like these are the means of affording many lessons. It is true that this ancient community of which we are members is likewise in one sense a young community, because it has about it the vigour, elasticity, and growth of youth; and while it expands in power we rejoice to believe that it is likewise growing more and more compact in internal solidity and strength. The meeting of class with class, to which reference has been made from several and distinct positions, tends to unite us in mind and heart. It is true I require to think that in the sphere in which I ordinarily live and move, so much has been done to consolidate the institutions of the country by improving its laws and by bettering the condition of its people. But it is also true that if we want to know what is the special security of our social strength and national prosperity we must look for it, not in what can be done by Parliaments and legislatures, but by the earnest, patient intelligence and self-denying efforts of men and public bodies, who do their duty each in his own sphere. And I know no more valuable instance of the success of such efforts than in the case of the evening classes in King's College. There is no doubt a great want to be satisfied—there is no doubt that the immense commercial progress and material activity of the age require not only stimulants but correctives. They require not that they should be repressed, not that they should be discouraged, but that they should be balanced by the higher cultivation of our nature—of our intellectual and moral and, above all, of our spiritual nature. There have been made efforts, which I cannot characterise otherwise than most gallant, to carry that higher degree of cultivation into spheres which of all others it was the most difficult for it to enter—I mean the sphere of those who are already burdened with the avocations which ordinary men may well deem to be fully equal to their strength, and such as entitle them when the ordinary labours of the day are done to retire to their repose. But it has been shown that there is in society, even in the heart of this vast and crowded metropolis, no inconsiderable portion of men—an increasing portion, I hope, and venture to believe—who are willing, even after the exhaustion of the day, to enter on new efforts, for the purpose of giving to their minds the immense advantages that are to be derived from refined education. In the profession to which I belong we do, for six months in the year, at any rate, know something of what it is, within the compass of 24 hours, to finish one day's work and then to go down to Westminster and begin another. So far I am able to sympathise with you, because that which we do under the strongest obligations—that which I venture to say we must do almost whether we like it or not — you have done by a free and spontaneous effort, and the result is recorded in the marks of distinction which I have just distributed. I for my part do not go down as far as the lowest classes in this country are concerned. It becomes a matter of increasing difficulty to induce even young men among us to make the efforts and exertions which are necessary to achieve progress in the work of education. There can be no doubt that we require in all classes of society the stimulus of necessity in order to induce us to labour and to reap through labour the reward it produces. It is impossible not to see what immense labour is required of the teachers of our schools and our Universities, who have to do with the highest classes of the country, and in how many cases it happens that the most devoted labours bestowed in the most intelligent manner and with a zeal and self-denial not to be exceeded produce but slender results; but there is a broader stratum of society, an immense mass of intelligent material, which is susceptible of every kind and degree of cultivation; and if we have come to the time when, in certain classes of society, the attractions of wealth and the outer world prove too much for the more sober attractions of learning, then it has become more than ever necessary that we should look downwards into those veins of rich material in which the English nation abounds, and that, by efforts such as these, new recruits should be continually brought forth in increasing numbers to add themselves to the body of those who are the followers of the muses or students in the inferior walks of letters and mental cultivation. It is therefore a great work to which the promoters of these evening classes have addressed themselves, and the importance of which cannot be measured even by the results attained within these walls. Much may be done here, but why should not that much be multiplied elsewhere? You have had no advantages, you have had no powers, except what are possessed by others. What a man has done a man may do; but you have lifted up a lamp in the face of the country which I trust will serve to lead others to imitate the efforts here made, and to draw forth industrious youths — not excluding other periods of life, for nothing has struck me more than the manner in which varied ages are here combined in one affectionate brotherhood and one generous emulation—to draw forth the struggling energies of youth, to satisfy its nobler aspirations, and to call it away, not only from vice and dissipation, but from sluggishness and indolence, and to encourage every man to find within himself, and to develope to the best of his abilities, the gifts with which Providence has endowed him. I rejoice to see that these evening classes have been attended by no common success. I need not say how cordially I wish the promoters continued success in their meritorious labours, nor need I assure those to whom I have had the honour of distributing, with my own hands, the prizes and certificates, how earnestly I desire that the rewards they have received, and the testimonials afforded to them to-night may be to them not merely signals and records of what they have done, but also much more—namely, incentives and encouragements to persevere in a continuing industry, to continue the cultivation of their gifts, to consider themselves responsible before God and man, every one of them, for applying and opening up to the best of their ability all the faculties they possess, and to find in the exercise of those faculties, and in their exertions in every work that is for the glory of God and the good of man, no small solace amid the difficulties of life, no small pledge that, when that life comes to its close, it may prove to have been but the harbinger of a better and a brighter one. I beg to return you my sincere thanks for the vote you have passed, and to assure you that the instruction which I receive, and the practical knowledge I derive from meeting you on an occasion like the present encourages me in the laborious profession to which I too am given, and satisfies me more and more that the increasing strength and happiness of this country will continue to be found in efforts like this—in conscientious individual exertion, each man striving for himself to do his duty to the best and utmost of his ability in that sphere and station of life to which it has pleased God to call him.

Home Correspondence.

THE SEWING MACHINE.

SIR,—Your last impression contains a letter on the Sewing Machine, in which the writer asks, "why it is only used for complicated and ornamental sewing, and not for sewing two selvages together?"

Now, sewing selvages together in the manner spoken of, forms but a small portion of the business of the seamstress; the seam not being sufficiently strong is, in almost all cases, superseded by the fell seam, which is performed in the most perfect manner by the machine.

Shirts are now entirely made by the machine, except the sewing on of buttons and working the button holes. The greater part of tailors' work is also performed by the machine, the tailor having little to do except fitting and finishing.

The fact of shirts being made throughout by the machine is sufficient to show its applicability to domestic purposes.

Mr. Reveley also asks, "why the machine uses three times the amount of thread used by hand?" This is not the case. In a machine producing the lock-stitch, one yard and-a-half of upper thread, and one yard and-a-quarter of bottom thread, are required for one yard of fine stitching; whereas, by hand, it requires three yards of thread for one yard of stitching. In coarse work the machine has a greater advantage.

The waste is also much less, for, by the machine, ten yards of stitching may be done without stopping, and by hand it is necessary to rethread the needle for each half-yard.

Mr. Reveley further intimates that a higher charge is made for sewing by the machine. This is also a fallacy, as in the best paid work, viz., collars, 9d. per gross is paid for stitching, some of the girls earning, at this rate, £1 per week. Anyone who knows the price of hand work will at once admit that this is much cheaper.

I am, &c.,

A. CLEGG.

7, St. James's-place, Hampstead-road, N.W.

WATER SUPPLY IN SOUTH AFRICA.

SIR,—The late severe drought in the South African provinces has attracted considerable attention towards the discovery of means for providing such supplies of water as shall mitigate the severity of future dry seasons. The time has hardly yet arrived for the utilisation of the waters of the Orange River, by raising the banks, constructing irrigation canals, and otherwise providing for agriculture. Much, however, may be accomplished by such associations as the "South African Irrigation Company," in damming small streams, digging tanks, and protecting the water thus stored by the encouragement of a judicious vegetation. Nor, following the idea first started by Dr. Livingstone, are artesian wells entirely hopeless. There are many favourable localities in which deep borings might be made (especially in the Dutch African republics) with every prospect of success. A late writer in *Chambers' Journal* states, in an article entitled "The Home of the Gazelle" (1862), that artesian wells have been successfully made in Algeria, in the northern borders of the Sahara, but his remarks require confirmation. Could any of your scientific readers verify the assertion?

If, as this writer declares, French engineers have succeeded in procuring a perennial supply of water south of the Atlas chain of mountains, there can be but little doubt that similar supplies could be obtained in many places in the south of the Continent.

Should any of your readers be able to direct me to any French or English publication, descriptive of the accomplishment of this alleged engineering feat, it would oblige,

Yours, &c.,

J. F. W.

2, Market-terrace, St. Leonard's-on-Sea.

Proceedings of Institutions.

LEICESTER CHURCH OF ENGLAND INSTITUTE.—The fifth annual report presented to the general meeting o the members, held on the 30th January last, says that the committee of the Church of England Institute feel justified in claiming a very fair measure of success for the Institute during the past year. The present number of junior members is 65, showing an increase of 18 over the corresponding quarter of the previous year. The subscriptions of the junior members for the year 1862 also show an increase of £3 0s. 2d. over those for 1861. The Committee believe that the classes of the Institute were never in a more flourishing condition than at present. There could not be a more satisfactory proof of the interest taken by the members in the work of self-education and self-improvement. The following statement will show the present condition of the classes, and the numbers by which they are respectively attended. It will of course be understood that in many cases the members of one class attend others also:—Arithmetic, 15; English history, 6; music, 13; Latin, 6; German, 5; Greek, 2; essay and discussion, 8; French, 26. The best thanks of the Committee are due to the teachers of the several classes. The Committee in their last report held out the hope of aiding in the establishment of reading-rooms for the working classes in various parts of the town. One such reading-room has been established during the past year in Union-street, out of High-street, and is aided by the loan of some periodicals from the Institute. The Committee would gladly extend the operations of the Institute in this direction. The Treasurer's statement shows that the expenses have been £94 2s. 6d., and that there is a balance due to the treasurer of £15 8s. 8d.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Entomological, 7.
British Architects, 8.
R. Asiatic, 3.
Royal Inst., 3. General Monthly Meeting.
Royal United Service Inst., 8½. Lieut. P. H. Colomb, R.N., "Naval and Military Signals."

TUES. ...Civil Engineers, 9. President's Annual Conversazione.
Photographic, 8.
Ethnological, 8. Professor Tagore, "A Discourse on the Institution and Formation of the Caste System in India, Aryan Polity."
Royal Inst., 3. Prof. Tyndall, "On Sound."
Architectural Museum, South Kensington, 7½. Mr. J. C. Robinson, "On the Art Collections at South Kensington, considered in reference to Architecture."

WED. ...Society of Arts, 8. Mr. William Hawes, "On the Results of the International Exhibition of 1862."
Geological, 8. 1. "On the Relations of the Sandstones of Cromarty with Reptilian Footprints." By the Rev. George Gordon LL.D., and the Rev. J. M. Joass; with an introduction by, and communicated by, Sir R. I. Murchison, K.C.B., &c. 2. Mr. J. Prestwich, "On the Section at Moulin-Quignon, and on the peculiar character of some of the Flint Implements found there." 3. Mr. J. Carrick Moore, "On some Tertiary Shells from Jamaica." With a Note on the Corals, by P. Martin Duncan, M.B. Lond., F.G.S. 4. Mr. J. Denis Macdonald, "Description of a new Fossil *Thecidium* from the Miocene Beds of Malta." Communicated by the President.

THURS. ...Antiquaries, 8½.
Linnæan, 8. 1. Mr. S. J. A. Salter, "On a sexual Monstrosity in the genus *Passiflora*." Messrs. R. Trimmen and Charles Darwin, "On the fertilisation of *Disa grandiflora*, *L.*"
Chemical, 8. Mr. Marcellin Berthelot, "Synthetic Methods in Organic Chemistry."
Royal Soc. Club, 6.
Royal Inst., 3. Prof. Ansted, "On Geology."

FRI. .....Philological, 8.
Royal Inst., 8. Mr. John Ruskin, "On the Forms of the Stratified Alps of Savoy."
Archæological Inst., 4.
R. United Service Inst., 3. Lieut.-Col. A. Strange, "Telescopes and Opera Glasses for use in the Field or at Sea."

SAT. .....Inst. of Actuaries, 3. Annual Meeting.
Royal Inst., 3. Professor William Thomson, "On Electric Telegraphy."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 15th April, 1863.

77. Bills—Local Government Act (1858) Amendment (amended).
78. ,, Telegraphs (as amended on Consideration of Bill as amended).
North America (Neutral Vessels and Mails)—Correspondence (No. 5).
North America (Neutral Rights and Duties)—Correspondence with Mr. Adams (No. 6).

SESSION 1862.

307 (C.) Poor Rates and Pauperism—Return (C).

Delivered on 16th April, 1863.

152. Naval Cadets—Return.
155. British Museum—Return and Estimate.
166. Exchequer Bonds—Account.

Delivered on 17th April, 1863.

160. Navy (Ships)—Return.
79. Bill—Savings Banks.
Army (Employment of Soldiers and their Children in Trades)—Report.

Copies of the under-mentioned Papers, presented by command, will be delivered to Members of Parliament applying for the same at the Office for the Sale of Parliamentary Papers, House of Commons:—

19. Turnpike Trusts - Fifth Report from Secretary of State.
20. Sanitary Condition of Barracks and Hospitals—Appendix to Report of 1861 (Interim Reports).

Delivered on 18th and 20th April, 1863.

156. Change of Name—Return.
157. Grants of Arms—Return.
168. Crown Lands (Ireland)—Returns.
172. Commercial Harbours—Return.

Delivered on 21st April, 1863.

151. Rotherham Sanitary Condition—Reports, &c.
162. Brewers' Licences—Returns.
170. Chapters—Return.
173. Army (Colonies)—Return.
174. Registry of Deeds (Ireland)—Return.
177. New Zealand—Correspondence.
176. Army (Manufacturing Establishments)—Return.

Delivered on 22nd April, 1863.

136. Savings Banks (Number of Depositors, &c.)—Accounts.
136 (1.) Savings Banks (Sums Paid or Withdrawn, &c.)—Return.
137. National Debt—Account.
158. Naval Prize Money, &c.—Return.
169. Public Income and Expenditure—Account.
178. Russian War, 1855 (Kertch and Yenikale)—Estimate.
179. Prince Consort's Memorial—Estimate.
29. Railway and Canal, &c. Bills (204. Birmingham and Sutton Coldfield Extension Railway; 205. Dublin Metropolitan Railway; 206. London, Brighton and South Coast Railway (New Lines to the Crystal Palace, &c.) 207. London Railway (Victoria Section); 208. Lynn and Sutton Bridge Railway; 209. Northumberland Central Railway; 210. Oswestry and Newtown and other Railway Companies Amalgamation, &c.; 211. Bonelli's Electric Telegraph Company)—Board of Trade Reports.

SESSION 1862.

396. Colonies (Public Officers)—Return.

Delivered on 23rd April, 1863.

147. Colonies (Area, Population, &c.)—Return.
148. Sugar Duties (Mauritius)—Return.
163. Brazil—Return.
165. Sewage Commission—Return.
167. Ecclesiastical Commission (Ireland)—Annual Report, &c.
171. Cathedral and Collegiate Churches—Return.
81. Bills—English Church Services in Wales (amended).
83. ,, Municipal Elections.
85. ,, Land Drainage (Provisional Orders).
86. ,, Poor Removal.
87. ,, Illegitimate Children (Ireland)—Lords Amendments.
Salvador—Treaty of Friendship, Commerce, and Navigation.

SESSION 1862.

476. Emigration—Return.

Delivered on 24th April, 1863.

29. Railway and Canal, &c. Bills (212. London, Chatham, and Dover Railway (No. 1)—Board of Trade Report.
181. Army (Employment of Soldiers in Trades)—Return.
183. Immigrants and Liberated Africans—Return.
84. Bills—Local Government Supplemental.
88. ,, Marriages &c. (Ireland) (amended).

SESSION 1862.

307 (A IX.) Poor Rates and Pauperism.—Return (A.)

SESSION 1861.

493. Poor Rate Exemption—Return.

Delivered on the 25th and 27th April, 1863.

101 (1.) Churchyards—Further Return.
145. Increase and Diminution (Public Offices)—Abstract of Accounts.
186. Metropolis Turnpike Roads—37th Report of Commissioners.
187. Roman Catholic Prisoners (Perth) Copy of Correspondence.
188. Militia (Ireland)—Returns.
193. National Portrait Gallery—6th Report of Trustees.
194. British North America (Arms, &c.)—Return.
118. East India (Chinchona Plant)—Return.
159. Australian Coal—Report of Commodore Seymour.
185. Queen's Aides de Camp, &c.—Return.
189. Judgments for Debts—Return.
199. Poor Law (Lancashire Unions)—Returns.
214. Registry of Deeds (Ireland)—Return.
91. Bills—Customs and Inland Revenue.
89. ,, Metropolitan and City of London Police Amalgamation.
Civil Service Commissioners—8th Report.
North America—Correspondence respecting Dispatch of Letters by Private Ships to Matamoros (No. 7.)
Coolie Immigration into the Island of Reunion from British India—Despatch.

Delivered on 28th April, 1863.

213. Court of Chancery—Abstract of Return.
45 (3.) Trade and Navigation Accounts (**31st March, 1863.**)
209. Railways (Entailed Estates)—Lords Report.
180. Survey (United Kingdom)—Returns.
190. Navy (Iron-Plated Ships)—Return.
195. Paper and Rags—Accounts.
204. Established Church (Ireland)—Return.
92. Bill—Courts of the Church of Scotland.
Smyrna (Fines inflicted)—Return.

Delivered on 29th April, 1863.

192. Paupers (Ireland)—Return.
197. Metroplitan Railways—Copy of Mr. Bazalgette's Report.
201. Education—Return.
82. Bill—Church Building and New Parishes Acts Amendment.
North America (Confederate Agents in England)—Correspondence with Mr. Adams (No. 8).
North America (Enlistment of British Subjects in the Federal Army)—Correspondence with Mr. Adams (No. 9.)

SESSION, 1862.

307 (A X.) Poor Rates and Pauperism—Return (A.)

Delivered on 30th April, 1863.

198. Tenure and Improvement of Land (Ireland)—Abstract of Returns.
215. Kitchen and Refreshment Rooms (House of Commons)—Report from Committee.
93. Bill—Naval Medical Supplemental Fund Society Winding-up Act (1861) Amendment.
North American (Seizure of Mail Bags on board the *Adela*)—Extract from a Despatch (No. 10).
Insurrection in Poland—Correspondence.

Delivered on 1st May, 1863.

191. Navy (Dockyard Officers, &c.)—Return.
203. Record Office—Return.
206. Army—Return.
212. East India (Civil Service)—Return.
217. Government Property—Return.
226. Ramsgate Harbour—Statement of Receipts and Payments, &c.
227. Salmon Fisheries (Ireland)—Return.
164. East India (Waste Lands)—Return.
94. Bills—Thames Embankment (North Side) amended by the Select Committee).
95. ,, Anchors and Chain Cables.
99. ,, Local Government Act (1858) Amendment (Lords Amendment).

Delivered on 2nd and 4th May, 1863.

175. China War (Votes of Credit)—Account.
196. Procession and Illumination Accidents (Metropolis)—Returns.
223. Seamen's Savings Banks—Account.
224. Mercantile Marine Fund—Account.
218. East India (Bheels of Kandeish)—Return.
216. Electric Light—Copies of Reports, &c.
222. Merchant Seamen's Fund—Account.
228. East India (Oude Claims)—Copy of Despatch.
229. Yorkshire (West Riding)—Return.
230. Bann Navigation—Returns.
101. Bills—Jurors Remuneration (amended).
102. ,, Watchmen in Towns (Ireland).
98. ,, Sheep, &c. Contagious Diseases Prevention.
100. ,, Stock Certificates to Bearer (amended.)

Delivered on 5th May, 1863.

90. Bills—Poisoned Grain Prohibition.
103. ,, Accidents Compensation.

Delivered on 6th May, 1863.

210. East India (Railways, &c.)—Return.
225. Church Lench School—Return.
96. Bills—Poor Removal (No. 2).
97. ,, Inland Revenue.

Delivered on 7th May, 1863.

211. East India (Consulting Railway Engineers)—Returns.
221. Fortifications—Account.
104. Bills—Uniformity Act Amendment.
111. ,, Security from Violence (amended).
Poland—Further Correspondence (Part 2.)

Delivered on 8th May, 1863.

219. Thames Embankment (North Side)—Report from Committee.
221. Fortifications—Account (a corrected copy).
233. Procession (7th March)—Return.
234. County Treasurers (Ireland)—Account.
242. Steam Postal Service (Australia, &c.)—Return.
231. Fisheries (Ireland)—Copy of Correspondence.
112. Bills—New Zealand Boundaries.
113. ,, Offences (South Africa).
Public General Acts—Cap. 8, 9, 10, and 11 (Delivered on 4th May).

Delivered on 9th and 11th May, 1863.

146. Superannuations (Public Offices)—Account.
182. Works and Public Buildings—Abstract Accounts.
207. Royal Forests and Woodlands—Return.
236. Holyhead Packet Harbour—Return.
237. Navy (Iron-Plated Ships)—Return.
238. Floating Piers (Thames)—Return.
244. Sevastopol (Arms, &c.)—Return.
245. Poor Law (Patrick Bourke)—Return.
105. Bills—Sale of Mill Sites, &c. (Ireland).
109. ,, Pier and Harbour Orders Confirmation.
110. ,, Harwich Harbour.
114. ,, Stock Certificates to Bearer (as amended in Committee, and on Consideration, as amended).
106. ,, Drainage and Improvement of Land (Ireland).
108. ,, Volunteers.
115. ,, Sheep and Cattle (Scotland).

SESSION 1862.

307 (A XI). Poor Rates and Pauperism—Return (A).

Delivered on 12th May, 1863.

39 (1). Coroners' Inquests—Further Return.
132 (1). East India (Cotton)—Further Return.
154. Harbours of Refuge—Return.
251. Lord Chancellor's Benefices—Return.
246. Lisburn Election Petition Withdrawal — Report from the General Committee of Elections.
117. Bill—Salmon Fisheries (Scotland) Act Continuance.

Delivered on 13th May, 1863.

232. Ramsgate Harbour—Abstract of Supplementary Account.
237. Navy (Iron-Plated Ships)—Return (a corrected Copy).
243. Public Debt—Account.
250. Thames Conservancy—Paper.
252. Voters (Scotland)—Return.

Delivered on 14th May, 1863.

57. Post Office Packet Service—Estimate.
208. Union of Benefices Act—Return.
247. Lighthouses, &c., Act—Paper.
248. Income Tax—Return.
253. Dublin Port—Account.
254. Thames Embankment (North Side) New-street—Return.
107. Bills—Sheriff Courts (Scotland).
116. ,, Court of Session (Scotland).
118. ,, Marriages Registration (Ireland) (amended).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May 22nd*, 1863.]

Dated 21st January, 1863.

192. H. Caro and J. Dale, Manchester—Imp. in obtaining colouring matters, part of which imp. is also applicable to dyeing and printing.

Dated 19th February, 1863.

451. R. P. Roberts, Kennington-oval, Surrey—Improved axle boxes for carriages or vehicles. (A com.)

Dated 4th March, 1863.

603. J. F. Gits, Antwerp—An improved furnace for the revivification of animal charcoal.

Dated 20th March, 1863.

751. J. Brigham and R. Bickerton, Berwick-upon-Tweed—Imp. in reaping or mowing machines.

Dated 23rd March, 1863.

787. L. Christofleau, 60, Boulevart de Strasbourg, Paris—Imp. in fire-arms.

Dated 14th April, 1863.

940. R. A. Brooman, 166, Fleet-street—Imp. in hardening and colouring gypseous limestone and sand and calcareous stones. (A com.)

Dated 16th April, 1863.

955. J. L. McLay, Liverpool—Imp. applicable to mariners' compasses.
957. C. Terrett, Clifton-place, Stapleton-road, Bristol—Imp. in preventing incrustation in steam boilers.
959. W. Oldfield, Noble-street, St. Luke's—Imp. in the construction of locks, applicable to despatch and other boxes, writing and dressing cases, and other similar receptacles.
961. T. A. W. Clarke, Leicester—An improved construction of shuttle driver, and apparatus for working the same.

Dated 17th April, 1863.

963. R. Knight, Dunkirk, France—Imp. in treating and preparing iron, copper, and other wires for telegraphic and other uses for the purpose of preserving them from corrosion or decay.
965. J. Richmond, T. Richmond, and D. Harling, Burnley, Lancashire—Certain imp. in looms for weaving.
967. R. C. Clapham, Walker, Northumberland — Treating the waste liquors from bleaching powder stills in order to obtain hydrochloric acid and other products therefrom.
969. W. Massingham, Boston, Lincolnshire—Imp. in apparatus for cooling liquids.
971. B. J. Webber, Newton Abbott, Devonshire—Imp. in apparatus for separating corn from the ears, and for combing straw.

Dated 18th April, 1863.

973. W. S. Macdonald, Manchester—Imp. in apparatus for drying animal, vegetable, and mineral substances.
975. W. B. Burden, Malvern, Worcestershire—Imp. in wheels and axles applicable to locomotives, carriages, and paddle wheels.
977. T. Hunt, Banbury—Improved apparatus for obtaining motive power.

Dated 20th April, 1863.

979. C. Randolph and J. Elder, Glasgow—Imp. in surface condensers.

Dated 21st April, 1863.

985. A. Ford, Stewart's-buildings, Battersea-fields, and R. Rigg, 3, Great Winchester-street—An improved method of re-forming and re-using old or waste vulcanised india rubber.
987. J. Heap, Ashton-under-Lyne—Imp. in adjustable wrenches for nut pipes and pins.
991. J. W. Nottingham, Clayton-place, Kennington-road—Imp. in two-wheeled vehicles.
993. H. Donald, Johnstone, Renfrew, N.B.—Imp. in machinery or apparatus for bending or straightening metal plates.
995. W. C. Cambridge, Bristol—Imp. in the construction of harrows.

Dated 22nd April, 1863.

1001. T. Grace, Bristol—Imp. in reaping and mowing machines, part of which imp. is applicable to other useful purposes.
1003. E. J. Jeffs, 1A, St. James's-street, Old Steyne, Brighton, and T. Turner, Stanley-bridge Wharf, King's-road, Chelsea—Imp. in the making and constructing of carriage ways.

Dated 23rd April, 1863.

1007. J. W. Proffitt, Park-road, Peckham, and W. L. Duncan, 218, Pembroke-cottages, Caledonian-road—An improved mode and apparatus for distributing sand or any other suitable substance or substances on the railways and tramways.
1009. R. Richardson, Great George-street, Westminster — Imp. in railway permanent way.
1011. W. Clark, 53, Chancery-lane — Imp. in the manufacture of tiles, and in apparatus for the same. (A com.)
1013. P. McGregor, Manchester—Imp. in machinery for spinning and doubling.

Dated 24th April, 1863.

1015. J. B. Daines, 5, Little Argyle-street West, Middlesex—Imp. in the preparation of stone, plaster, compo, iron, wood, and such like substances, so as to preserve them from decay.
1017. J. Lambert, Sheffield—Imp. in ball cocks.
1023. J. Thompson, Bilston—Imp. in the manufacture of barrels for fire-arms and other descriptions of tubes, and in apparatus or machinery to be employed for that purpose.
1025. W. A. Shaw, New York—A mode of lining lead pipe with tin or its alloys.

Dated 25th April, 1863.

1029. L. de Breanski, Greenwich—Improved apparatus for fixing drills, which invention is also applicable for fixing apparatus for raising, supporting, and suspending weights, and for other analogous purposes.
1031. A. H. Clark and H. Hope, Birmingham—Imp. in valves for water, steam, and gas.
1033. J. P. Nunn and E. B. Nunn, Royston, Cambridgeshire—Imp. in hoes and cultivators.
1037. F. Walton, Chiswick—Imp. in the manufacture of fabrics for covering floors and other surfaces, and in apparatus employed therein.
1039. I. Dimock, Manchester—Imp. in machinery for cleaning, sorting according to size, and doubling silk and other threads.
1043. A. V. Newton, 66, Chancery-lane—Imp. in breech-loading fire-arms. (A com.)

Dated 27th April, 1863.

1045. S. Osborne, Bayswater—An improved machine for unwinding crinoline steel.
1047. H. E. Carchon and E. F. Raybaud, 17, Rue Thevenot, Paris—Imp. in the manufacture of hats and bonnets, and mode of preparing feathers to be used in the said manufacture.
1049. W. E. Gedge, 11, Wellington-street, Strand—Imp. in twyers or blast pipes, and in apparatus connected therewith. (A com.)
1051. W. Richards, Birmingham—Imp. in ordnance, fire-arms, and cartridges.
1053. F. Bennet, Holywell, Flintshire—An improved method of condensing lead and other metallic fumes and vapours from furnaces.
1055. W. H. James, Old Kent-road—Imp. in indicating the locality of fire, applicable also to denoting the position of ships.

Dated 28th April, 1863.

1059. S. Ingledew, Stockton-on-Tees, Durham—Certain imp. in the method of obtaining iron from its ore, and in the subsequent treatment thereof for converting the product into a metallic state, and in apparatus connected therewith.
1061. S. Crabtree, Bradford—Imp. in balling motions.
1063. A. Kinder, 20, Cannon-street—Imp. in the manufacture of sheet metal and in ingots or plates of metal, and in the machinery or apparatus employed therein.
1069. T. Moore, 27, Leadenhall-street—Imp. apparatus for laying down, protecting, and controlling submarine cables for telegraphing from vessels moored off a coast to the shore.
1071. G. Davies, 1, Serle-street, Lincoln's-inn—An improved machine for agitating and mixing substances.—A com.
1073. Capt. H. Y. D. Scott, R.E., Brompton Barracks, near Chatham—Imp. in the manufacture of cementitious substances.

Dated 29th April, 1863.

1075. J. Rowley, Stafford-street, Peckham, Surrey—Imp. in the means or apparatus employed for recovering the fibres of wool from fabrics or materials composed of wool combined with cotton or other vegetable substances.
1077. W. Tarr, 112, York-street, Oxford-street, and E. Tarr, 40, Cavendish-street, Oxford-street, Manchester—An imp. in pianofortes.
1079. E. Leigh and F. A. Leigh, Manchester—Imp. in cotton gins and in the method of driving the same, part of which improvements is applicable to other purposes.
1081. H. Worms, 27, Park-crescent, Portland-place—Imp. in apparatus for elevating guns.
1083. F. Gretton, Burton-upon-Trent, Staffordshire—Imp. in heating the contents of mash tuns.
1085. H. W. Ripley, Montpellier Lawn, Cheltenham—Imp. in apparatus for printing fibrous materials. (A com.)

Dated 30th April, 1863.

1087. J. Wibberley, Manchester—Imp. in machinery or apparatus for winding cotton, silk, wool, or other threads on spools or reels.
1089. W. Clark, 53, Chancery-lane—Imp. in the manufacture of hydrocyanite of ammonia and of alkaline and earthy cyanides. (A com.)
1091. E. G. Brewer, 89, Chancery-lane—Imp. in welding and rolling metals, and in machinery connected therewith. (A com.)
1093. J. Appleby, Manchester — Imp. in propelling ships and barges.

Dated 1st May, 1863.

1095. J. M. Gray, 80, Prince Edwin-street, Liverpool—Portable apparatus or instruments for rivetting, caulking, chipping, and otherwise operating upon and treating metals and other substances.
1096. E. Jones, Charlton, Kent—Imp. in drainage and in water-closets, and in the means and apparatus necessary for the same respectively.
1097. W. Clissold, Dudbridge, Gloucestershire—Imp. apparatus for fulling woollen cloths and washing and cleansing woven fabrics.
1099. J. Badart, 9, Bishopsgate-street—Imp. in the preparation of rape seed cake, linseed cake, poppy seed cake, niger seed cake, sesseme seed cake, and ground nut cake.

Dated 2nd May, 1863.

1101. W. T. Smith, Dalston, Middlesex—Imp. in washing machines.
1103. G. Burt, Birmingham — Imp. in machinery for punching, stamping, or forging metals.
1105. S. J. Bartlett, Maidstone—Imp. in apparatus for straining and drawing off liquids.
1107. J. T. Oakley and T. Oakley, Grange-road, Bermondsey—Imp. in the construction of garden pumps, part of which said improvements is applicable to fire-engines and other hydraulic machines.

Dated 4th May, 1863.

1109. E. R. Southby, Wareham, Dorset—Imp. in the extraction of scents from plants, flowers, and other odoriferous substances.
1110. J. Fortune, Morton, near Bingley, in York—Improved means of joining or fastening together lace, blond, quilling, or similar materials.
1111. J. M. Johnson, E. Johnson, and C. Johnson, Castle-street, Holborn, and L. Bertling, Ironmonger-street, St. Luke's—Imp. in the production of show tablets, advertisements tablets, name plates, architectural facings and decorations, and other ornamental, decorative, and inscriptive articles.
1113. G. Haseltine, 12, Southampton-buildings, Chancery-lane—Imp. in springs for railway carriages and other purposes.

Dated 5th May, 1863.

1115. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of wrought iron and steel, and in the apparatus to be employed therein. (A com.)
1116. W. Walsh, Manchester—Imp. in obtaining and purifying oxalate of soda, which improvements are also applicable to the manufacture of oxalic acid.
1117. R. G. Kent, Old Crompton-street, Soho—Imp. in the construction and arrangement of shades and reflectors for gas lights.
1119. W. Boothroyd, Halifax—Imp. in stationary engines or apparatus for obtaining motive power.
1123. J. H. Knott, Nelson-square, Blackfriars-road—Imp. in lamps.
1125. W. C. Wilkins, Long-acre—Imp. in lamps.

Dated 6th May, 1863.

1127. T. Sagar, Burnley, Lancashire, and J. Wilkinson—Certain imps. in power looms for weaving.
1129. W. E. Gedge, 11, Wellington-street, Strand—An improved toy. (A com.)
1131. S. Mac-Kellen, Manchester—Certain imp. in watches and other time-keepers.
1132. I. M. Singer, Glasgow—Imp. in sewing machines.
1133. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in machinery or apparatus for forging and dressing horse-shoe and other nails. (A com.)
1135. A. Sturrock, Doncaster — Imp. in locomotive engines and tenders.

Dated 7th May, 1863.

1148. T. Holliday, Huddersfield—An improved blue colouring matter.

Dated 8th May, 1863.

1150. A. Skwarcow, 24, Leadenhall-street—Imp. in the construction of turntables. (A com.)
1152. J. S. Grimshaw, Huncoat, near Accrington, Lancashire—Imp. in looms for weaving,
1156. W. Clark, 53, Chancery-lane—Imp. in coating wrought or other iron to protect it from corrosion or oxydation. (A com.)

Dated 9th May, 1863.

1162. S. Wilson, Manchester—Imp. in hoops or bands for fastening bales, and in machinery or apparatus for making the same.
1164. J. Norie, Glasgow—Imp. in making moulds for casting, and in apparatus therefor.
1170. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of lamp black. (A com.)
1172. J. Burrell, 85, Back Church-lane, Whitechapel—Imp. in machinery for cutting the teeth of bevelled wheels.
1174. J. Burrell, 85, Back Church-lane, Whitechapel — Imp. in salinometers.

Dated 11th May, 1863.

1178. R. Burgess, Machester—Imp. in machinery or apparatus for marking, etching, or engraving cylindrical and other surfaces.
1182. J. Parkinson, Tichbourne-street, Regent-street—A new or improved mode of manufacturing tablets to be used for monumental purposes.

Dated 12th May, 1863.

1188. W. Mattison and G. Barker, Leeming Bar, near Bedale, Yorkshire—Imp. in grass mowing and reaping machines.
1194. H. L. Emery, Sloane-street, Chelsea—Imp. in apparatus for manufacturing saws suitable for ginning cotton and for other uses. (A com.)
1196. R. A. Brooman, 166, Fleet-street—Imp. in spring mattresses, sofas, chairs, seats, and similar articles. (A com.)

Dated 13th May, 1863.

1198. H. Rushton, 48A, Northampton-road, Clerkenwell—Imp. in head dresses.
1202. F. Holthausen, 40, Rue de Richelieu, Paris—An improved portable copying press.
1204. V. J. Cassaignes, 8, Rue des Fosses, St. Jacques, Paris—Imp. in stereoscopes.
1206. B. Lambert, 35, Lothian-road, Camberwell New-road—Imp. in paper makers rag or pulp engines.

Dated 14th May, 1863.

1210. T. Lawrence, Salford, Lancashire—Certain imp. in machinery or apparatus used in the processes or operations of drying, dressing, brushing, waxing, and finishing fabrics.
1212. A. Pilbeam, Glasgow—Imp. in sewing machines.
1214. J. Burrell, 85, Back Church-lane, Whitechapel—Imp. in the construction of cocks or valves.

INVENTION WITH COMPLETE SPECIFICATION FILED.

1163. W. E. Gedge, 11, Wellington-street, Strand—Imp. in the manufacture of paper, stuff, or pulp, from certain vegetable substances. (A com.)—9th May, 1863.
1218. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in machinery for rolling, grinding, and cutting files and rasps. (A com.)—14th May, 1863.

PATENTS SEALED.

[*From Gazette, May 22nd*, 1863.]

May 22nd.

3167. T. M. Elton.
3170. J. Steinthal.
2171. F. Palling.
3174. J. R. Danks, B. P. Walker, and R. P. Walker.
3176. J. Halford.
3179. T. Keyworth.
3180. W. T. Rowlett.
3181. D. Auld and D. Auld, jun.
3183. D. Veerkamp and C. F. A. Van Trigt.
3415. G. E. M. Gerard.
3422. F. Parker.
3473. H. A. Bonneville.

LIST OF DESIGNS OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietor's Name.	Address.
4558	May 15.	Improved Photographic Printing Frame ...	Walter Blott.....	532A, New Oxford-street.
4559	,, 20.	Incubator	Hugh Hanly	1st Life Guards, Regent's-park, N.W.
4560	,, 26.	Machine for Freezing, Cooling, and Churning	Rupert Rains	4, Crescent, Bridge-street, Blackfriars.